A

PRACTICAL TREATISE

ON

Brewing, Distilling, and Rectification,

WITH

THE GENUINE PROCESS OF MAKING BRANDY, RUM, AND HOLLANDS GIN,

The London Practice of brewing Porter, Ale, and Table Beer, the Method of brewing Country Ales, &c.

WITH THE MODERN IMPROVEMENTS IN

FERMENTATION, OR THE DOCTRINE OF ATTENUATION,

IN WHICH THE OLD AND PRESENT MODE OF WORK IS IMPROVED, WITH

AN ENTIRE NEW SYSTEM, MUCH MORE ADVANTAGEOUS;

INTERSPERSED WITH

PRACTICAL OBSERVATIONS

ON EACH KIND OF FERMENTABLE MATTER, RAW AND PREPARED, WITH RULES FOR OBTAINING THE GREATEST QUANTITY,---AND OF BETTER QUALITY, FROM GRAIN, RAW OR MALTED, SUGAR OR MOLASSES;---AND

THE MAKING WINES, CIDER, AND VINEGAR;

THE WHOLE FUNDAMENTALLY DELINEATED WITH PLATES:

WITH

A COPIOUS APPENDIX

ON THE CULTURE AND PREPARATION OF

Foreign Wines, Brandies, and Vinegars,

PREVIOUS TO EXPORTATION,

And the best Method of Managing them when imported into these Kingdoms.

BY R. SHANNON, M.D.

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1805.

SHANNON

ON

BREWING, DISTILLING, WINES,

Cider, Spirits, and Vinegar.

PREFACE.

I Have been for many years collecting Information and laying up Materials, derived from Observation *and* Experience, *both at* Home *and* Abroad, *with a view to render this Treatise equal to every thing expressed in the Prospectus.*

The numerous opportunities I have had rarely occur in the life of an individual; and the assiduity and attention with which I have availed myself of them, both in Public *and* Private Breweries, &c. *where I have* inspected, assisted, *and* practised, *joined to a peculiar turn for these studies, gave me advantages that were seldom united in any one Person who has hitherto undertaken to assist the judgment of the* Brewer, *or improve the* Process *of* Brewing, *so as to make a wholesome, substantial Beverage for the Public,—the Salubrity of which it has been too much the fashion, not only to doubt, but misrepresent. What I here say of Brewing, may, with great truth, be applied to every* Article *enumerated in the* Title Page *of this Work, and its subsequent Contents. An early and intimate knowledge of our own Breweries and Distilleries, derived from family connections, disposed me to be a closer and more attentive Observer of those of our Neighbours, the Breweries and Distilleries of Germany, Holland, and Flanders, and the Vineyards and Distilleries of France, Portugal, Spain, &c. which has enabled me to correct, and I hope improve, what I have found so faithfully detailed by others, as to adopt. I do not pretend to teach the Adepts in those professions their business, but merely to clear the way where difficulties unavoidably occur.*

In default of more able hands taking up the subject in these kingdoms, I have ventured to give the result of my Observations and Enquiries as an auxiliary aid to those Gentlemen engaged in the Culture, Commerce, and Management of Wines; to which I have been encouraged by the alacrity with which they supported the undertaking; to some of whom I stand indebted for information.

The very rapid progress of improvement in Natural Philosophy and Chemistry, as applicable to Agriculture, Commerce, and the Arts, should enable us to correct Abuses, detect Frauds, and expose the Artifices which some few men have been selfish and wicked enough to propagate. To remove the prejudices and misrepresentations disseminated by some Authors against the Salubrity and genuine Qualities of the Wines of other Countries, and the Malt Liquors of our own, was an additional motive for giving the following sheets to the world.

That it has been a Work of some promise, the numerous List of Subscribers is the most authentic proof;—to have upwards of seven hundred copies engaged, before it came from the press, must be very flattering, a great majority of whom are men of such talent and Opulence, as would do credit to any Work. I am not insensible how incomplete a Work, embracing so many interesting and important Objects of a scientific and practical Nature, undertaken and accomplished by one Person, on so extensive a Scale, is liable to be; but hope that no Errors it may contain will be found to render it so imperfect, as to disappoint the expectations of the inquisitive reader, on any of the subjects that compose this arduous undertaking.

Though far from being indifferent to the censure or applause of modern critics, the meeting with the approbation of the respectable classes of men for whom this Work was principally written, must render me less susceptible of either. Those most capable of correcting these errors, will, I am persuaded, be most ready to excuse them; and, from being better able to prosecute the subject, may add their own scientific and practical hoards to the common stock of public information. Through the whole of the Four Books of this Treatise, I have, as cautiously as I could, consistently with the nature of the Work, avoided hurting the feelings, or reproaching the conduct of any class of men.

It is hoped the inaccuracies of the author, and errors of the press, will be excused, as they do not arise from a want of attention, but a want of opportunity, the whole of the time employed in preparing the work for the press being a trespass on professional avocations.

DEDICATION.

TO

NICHOLAS VANSITTART, ESQ.

THIS laborious attempt to establish, on some solid basis, the production of good and wholesome MALT LIQUORS in the United Kingdoms of Great Britain and Ireland, on the quality and strength of which every class of people may depend, and in which the Health and Interest of all Ranks of People are concerned,—shewing, from their incredible consumption, the increase of revenue that arises to Government;—with the Culture, Preparation, and Management of Foreign Wines, Brandies, and Vinegars, including directions for the choice, and observations on the sanative qualities of each;—the Distillation of Spirits, and production of other Domestic Liquors, their use and abuse, as also their Financial Resourse to the State,—is respectfully Inscribed,—as the promoter of Science, the Encourager of Arts, Manufactures, and Commerce, and the real friend of the United Kingdoms.

By his most grateful humble Servant,

R. SHANNON.

No 2, Bruton Street, Berkeley Square.
September, 1805.

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Four Merchants, by Mr. G. Quin

Abbreviations...P B *Porter Brewer*...A B *Ale Brewer*...A and P B *Ale and Porter Brewer*... B *Brewer*.....D *Distiller*.....G D *Grain Distiller*....M D *Malt Distiller*....M D and R *Malt Distiller and Rectifier*...D and W M *Distiller and Wine Merchant*...D and S M... *Distiller and Spirit Merchant*...D and V M *Distiller and Vinegar Maker*...M W *Maker of Wine*...W M *Wine Merchant*...W and B M *Wine and Brandy Merchant*...B and R M *Brandy and Rum Merchant*...V M *Vinegar Maker*...W and V M *Wine and Vinegar Maker*. G D and R *Grain Distiller aud Rectifier*...C M *Cider Merchant*...B A B *Burton Ale Brewer*...W P *Wine Planter*...S D *Spirit Dealer.*

BOOK THE FIRST.

PRACTICAL BREWING.

SIDNEY, Printer, Northumberland-Street.

PRELIMINARY OBSERVATIONS

ON

BREWING.

The Process of Brewing, and the Doctrine of Fermentation, of so much importance to these Kingdoms, may be so improved, that the same lengths usually drawn by the Brewer, Distiller, Vinegar-maker, &c. will be considerably stronger, though they should contain no more than the quantity of fermentable matter usually obtained per barrel; that is, all vinous, or fermentable fluids, intended for Wine, Porter, Beer, Ale, Malt, and Molasses-wash, Cyder, Vinegar, &c. of the specific gravity they at present contain, will, by this new mode of fermentation, produce the whole considerably stronger, of better quality, and less liable to accidents, than they are now procurable at from the same quantity and quality of materials by the old process of fermentation.

The influence hitherto produced by the changes of atmosphere on all fermentable and fermented fluids, may be now successfully obviated; so that fermentation may not be impeded, nor foxing, flatness, or sourness, in future occur; and, if from negligence, or other causes,

any of them should happen, they can, with certainty and advantage, be removed; the wine, beer, wash, &c. restored; their vinosity, spirituosity, pungency, transparency, and flavour, improved and preserved; and the whole of the volatile principle of the Malt and Hops saved, with at least one half of the Time and Fuel; which renders the preparation of wine, beer, wash, vinegar, and all fermentable fluids, a manageable thing at all seasons, and in all climates.

The author would be very sorry it should be supposed he meant to hurt the feelings of professional men, by attempting to teach them their business, his wish being merely to facilitate it, by removing difficulties that lay in their way, and have hitherto been found irremediable; to improve the flavour, strength, and quantity, of the produce, to expedite the process in each, and cause a considerable saving in the expence of the whole, are the real objects of his proposed improvements.

The Art of Brewing, or extracting fermentable liquors from grain, is, in general, supposed to be more modern than the process of pressing and preparing wine from the grape. Buchanan, in his History of Scotland, mentions the use of malt liquor in that country at a very early period, and calls it *vinum ex frugibus corruptis*. Galen, who lived at Rome, and flourished in the reigns of Antoninus Pius, Antoninus Philosophus et Commodus; and Dioscorides, the favourite of Mark Anthony and Cleopatra, were neither of them strangers to ale; but as the ale they speak of, is represented as having been injurious to health, as affecting the head and nerves of all who drank it; of vitiating the animal juices, and causing a drunkenness more obstinate and painful in its effects than wine, it is fair to presume, that it was unhopped and ill fermented.

Herodotus, who wrote 500 years before Christ, attributes the discovery of brewing, many years before, to Isis, the wife of Osiris, in Egypt.

Egypt. Now Osiris, according to some learned writers, is the same with Misraim, the son of Cham. Thus it appears that the invention of wine is ascribed to the grandfather Noah, and that of ale to the grandson Misraim.

All these considerations, however, do not absolutely prove, that malt liquor was in use among the antideluvians; still they afford a strong probability of the fact.

We shall not dwell upon the antiquity of malt liquors; but employ ourselves more usefully by investigating their qualities, marking, in some instances, their progressive improvement, and in others, shewing their declension.

It is worthy observation, that the legislature of the present day, have watchfully guarded against the substitution of any bitter by the common brewer instead of hops; although, by an Act of Parliament passed many years ago, their use was strictly prohibited in malt liquors; and this law, I am inclined to think, has never been repealed, unless the acts lately passed to prohibit the use of other bitters in the brewing of malt liquors intended for sale, may be considered as an abrogation.

This contradiction evidently displays a want of information in the legislature at one or other of these given periods, with respect to the quality, and application of this useful plant, at present a source of considerable revenue to government. In the year 1798, the duty on hops amounted to 56,032*l.* 1*s.* 6¾*d.* and it is computed they will more than triple that sum this year (1804). Extraordinary as this may appear, it is not less a matter of fact, and may, one day or other, lead to an enquiry, how far, in the scarcity of hops, other bitters may be substituted, without prejudice to the flavour or quality of the malt liquor to which they are applied.

Should

Should gentian, quassia, and other bitters, be found equally wholesome, there can be no exception to them, except their not producing an excise equal to that levied on hops; an evil which it is presumed the legislature could easily remedy, if a scale of their relative strength was made out, graduated to the correspondent strength of hops, and the resources of government continue unimpaired by the change. The same may be said of raw corn, where the use of it, in carrying malt liquors to greater perfection, may be found expedient by the brewer. In short, government, the public, the common brewer, all, would derive considerable advantage from the removal of those legal, unpolitical, obstacles to the progress of improvement, which, in this enlightened age, should not be permitted to enervate the hands of industry.

The genuine flavour for which porter was formerly distinguished, and coveted both at home and abroad, has, of late years, very much declined, and that in proportion as the grist has been varied, by mixtures of pale, amber, and brown malt, which compose modern grists, instead of the old system of employing all brown, or brown and amber malts.

Those houses who still regard with attention the genuine flavour of porter and brown stout, brew a superior article; the many who do not, draw an extract from all pale, or nearly all pale, malt; induced so to do, from these malts being more productive, which produce a pale extract more of the ale than beer flavour; a malt liquor very different from porter, notwithstanding the pains taken to colour and give it that face. Before these deviations were made, a good sound liquor was drawn from the best pale malts, much about the strength of intire butt beer, or brown stout, sold under the name of old Hock. Of this we shall see more under its proper head.

This will probably appear less exceptionable to the reader, when I have delivered some essential particulars to assist his judgment, in exonerating

exonerating the common brewer from the implied censure these observations may seem to convey, which will occasionally occur in the General Remarks composing these Preliminary Observations, and become evident, when we are taught to see things such as they really are.

Brown malts, from what is called high dryings, are partly candied, and partly burnt; and some of them blown, that is, considerably augmented in bulk. To the combination of these bad qualities, porter owed its peculiar flavour, at the same time very considerably lessening the produce of fermentable matter per quarter, which the low price of materials at the time, and the inexperience of the brewers, prevented from being so much an object of consequence as at the present moment.

As materials became dearer, reflection suggested, and experience proved, that the greater the quantity of pale, or pale and amber malt, the grists contained, the stronger the extract, or beer, or ale, must consequently be, and the greater the length drawn from an equal quantity of materials.

This beneficial change for the brewer necessarily introduced colouring more and more in proportion as the worts and subsequent beer or ale became pale from the decrease of brown malt; for, although absolutely stronger, they would appear weaker to the eye, and less like porter to the palate, by which means the genuine porter flavour has gradually declined, while the colour has continued much the same.

The genuine flavour of porter, hitherto thought inimitable, (that is, before those changes had taken place which we have just described) gave rise to an opinion, that no other than Thames water was calculated to produce good porter; which became so general, that not only this kingdom, but the world at large, where porter was known and prized as a beverage, considered its brewing as locally confined to London.

Although

Although nothing, perhaps, is so generally known, and so little understood, as the process of brewing beer or ale, yet at every inn, not immediately in the vicinity of London, you may find an ostler, or an old woman, whose province it is to brew strong beer, or fine ale, for home consumption; and the same thing occurs in almost every gentleman's family in the country. In short, every cookery book gives you a receipt for brewing one sort or other of malt liquor.

Voluminous as the catalogue is of these domestic brewers, I am hardy enough to assert, that not one of them know how to brew a single gyle of porter. I will even go further, and insist, that the number of those who can brew any kind of strong beer, or ale, to advantage, is very limited; that is, although many of them can brew good drink with good malt and hops, allowing it a proper time to become fit for use, yet they do so by habit, not being in possession of any standard for the systematic appropriation of heat, and the quantities of liquor turned over, or knowing how to regulate the lengths, quality, or strength of the worts extracted, so as to proportion them to the variations of their grist; or, in fact, to form any certainty of the qualities impressed on the future beer, from the previous mashing, or subsequent fermentation.

It is strange to relate, that men of many years experience, some of them brewers of the London school, known under the appellation of ale, amber, and table-beer brewers, do not always succeed in their first attempt to become porter-brewers; and more so, that there are some among them, who never brew, what is called, a good article.

Notwithstanding the authenticity of these assertions, and others that might be adduced, equally conclusive, many idle projects are attempted; the most methodical, and very best of which, are founded in misconception of the excise laws, and a total ignorance of the genuine process. Yet these wild schemes at improvement are pro-

posed

posed by men, whose very explanation on the subject clearly demonstrate their incapacity for the undertaking; although the fact is, the present process is capable of being advantageously improved. Even the London Brewers are not agreed among themselves on the process, *each* pursuing a different road to the same object, and *all* pretending to some secret with which the others are supposed to be unacquainted.

I have proved to some of the most able of them, and can readily demonstrate it to the world, that the genuine porter flavour, for which it was formerly so much distinguished and coveted, both at home and abroad, has of late years so very much declined, for reasons that need not be repeated here; that the brewing of porter, hitherto thought local, is successfully carried on in different parts of the country, and is now attempted in Scotland and Ireland, particularly in the latter, with great probability of success, and in no long time may not be wholly confined to these kingdoms.

These seemingly contradictory facts are not enumerated for any other purpose than to shew the obscurity in which the subject is involved, through the mysterious conduct, ignorance, and errors, of the generality of the trade themselves, though gradually brought to a degree of science by the Common Brewer, compared to the irregular and unprofitable practice of the Private Brewer.

It must be allowed, that it is no very easy task, as the law now stands, to preserve the intrinsic qualities of an article, the price of which has been until very lately stationary, while the articles that compose it were more than fluctuating, having progressively rose for some years past. Indeed, the present price of materials, compared with that which they bore when porter was raised from three-pence to three-pence half-penny per pot, bears nearly an increase of 100 per cent. This first rise took place about the close of the last, or beginning

of the present reign. I wish to make the price of porter, strong beer, and ale, as stationary as the price of BREAD, and the strength as ascertainable.

I must beg leave to remark, lest these observations should appear to countenance the rises, that I am by no means an advocate for it; on the contrary, I could give the most sound reasons why it should not be, if the discussion would not lead me beyond the prescribed limits of this paper. This much, however, I will hazard, that, with the assistance of the legislature, this branch of trade might be made more advantageous to the public, more beneficial to the brewer, and much more productive to government, than in its present state.

These gradual changes, which observation and experience have enabled me to point out, with the increasing price of materials, and the stationary price of the article brewed, necessarily induced the brewer to study the least expensive means of giving strength, without the loss of flavour, in which he has not succeeded for want of a deeper knowledge of his materials.

This has reduced our boasted beverage to a mere semblance of what it was, and so far divested it of local superiority, that there is now brewed in many parts of the kingdom porter equally good with that made in London. This is a serious, and will become an increasing evil to many of the great houses in London, unless some judicious means are suggested to remedy it.

The average quantity of fermentable matter, per quater, in malt of the first quality, is from 88 to 62lb. per quarter; which would give a mean of 75lb. per quarter; but the common average is between 82 and 54lb., that is, 68lb. per quarter; which is about $22\frac{1}{2}$lb. per barrel, at 3 barrels per quarter, $20\frac{1}{2}$lb. at 10, and $18\frac{1}{2}$lb. at 11 barrels per 3 quarters of grist; ascertainable by the hydrometer. These are not positions assumed without proof.

The

The obvious intention of malting corn, is to evolve the saccharine matter, and resolve the gluten of the grain in which it is involved, so as to facilitate the solubility of the mucilage, and thereby dispose the whole of the farina, or flour of the grain, to dissolve in the liquor turned over each mashing for the formation of the WORTS. For this purpose malting has been originally introduced, which in itself is a vegetative species of fermentation; by which the grain malted exhausts part of its strength, actually and relatively; actually, in the process of vegetating the acrospire; and relatively, in the loss of weight. The bulk is also considerably increased in some malts, insomuch, that three measures, or quarters, of barley make four of malt; but to take the average at one in five, it is twenty per cent. loss on malting; and to compute at this rate only, makes a deduction of twenty quarters in every hundred quarters brewed; consequently a loss of so much of the farina, or flour, of the grain malted, compared to the same number of quarters of unmalted grain.

And what, I would ask, is gained in return for this reduction of quantity? Probably these enquiries may not have been familiar to my readers. I will, therefore, answer for them, by granting as much as can possibly be granted, viz. that the body of the grain is opened by the process of malting, which, being itself a vegetative species of fermentation, renders the farina, or flour, of the corn more soluble in the mash-tun; and disposes the worts at the same time more aptly to ferment in the gyle-tun, which facilitates the process of brewing, in its present state, by malting the grain, though to the absolute impoverishment of the gyle, and subsequent beer, without any advantage to either, in quality or strength, as the grists are now made up. Hence, malting in the gyle-tun, if equally safe and certain, should proportionably cause a reduction of malted, and an increase of unmalted corn at every brewing.

It now remains to be shewn, that the process may be conducted with equal facility, safety, and certainty, with a saving of twenty per

cent.

cent. in quantity and quality, as above stated, and a gain of twenty-five per cent. in the price.

Barley, on an average, is ten or fifteen shillings per quarter under the price of malt, and produces one-third more fermentable matter; porter owes its peculiar flavour to high dried barley, not quite two-thirds malted; we may, with truth, compute the best barley to contain a comparative strength of, from 82 to 91 or 100lb. per quarter; the average strength will be, from about 91 to 96½lb. per quarter, and the produce, about 30½ to 32lb. per barrel. This is nearly the specific gravity, or strength of the distillers' wash, who use unmalted in a much greater proportion than malted corn, in their grist; and bring up the weight with one-tenth of the whole of malt made into Lob. Hence the difference in whole numbers between a barley grist and malt grist is 7lb. that is, taking the former at 30lb. and the latter at 23lb. per barrel; if one-third barley only is used, that is, one quarter in every three quarters brewed. This is a matter of fact calculation, therefore incontrovertible, and although it may appear extraordinary to the brewer, the distiller can bear testimony to the truth, as far as comes within the line of his own business. This is nearly 25½lb. per barrel, at 9 barrels per quarter; 22¾lb. at 10 barrels to 3 quarters of grist; 20½lb. at 11 barrels; and about 19lb. on 12 barrels to 3 quarters of grist; composed of one-third barley and two-thirds malt.

With respect to the fermenting part of the business, it is as practicable by my proposed plan as by any other now in use.

The judicious brewer will, perhaps, tell me, that the distillers' fermentation differs from the brewers'. I admit that it is so, and it must ever continue so, while the one mixes malted with unmalted corn, and the other uses malted alone; but the brewer may, if he pleases, with the leave of the legislature, and with very little deviation from his own mode of working, and without any alteration in his utensils, safely reap the advantages of mine, by adopting the practice herein laid down.

Presuming that every man who proposes to follow business with advantage wishes to make himself perfect master of it, and hoping that most rational men will admit the justness of these observations, I shall proceed by stating, that brewing is a science, in the arrangement of which nature has almost as great a share, as in the ebbing and flowing of the tide; the necessity of studying its operations are therefore obvious.

Let us continue then our investigation with an enquiry into the nature and quality of the grain, or corn, used in brewing; and for the better elucidation, let us suppose a brewer, who has wanted either leisure or opportunity to investigate the subject himself, to ask, what is barley composed of? How are its properties altered by malting? And, What are the advantages obtained thereby?

First. Barley consists of a small portion of saccharine matter; a large quantity of mucilage, independent of the almost indissoluble parts, the husk and bran, and some animal gluten.

In the integral state of barley, the saccharine matter is so involved in the gluten, as not to be very perceptible until developed by malting. The mucilage consists of the whole farina, or flour of the grain, and may be separated from the saccharine matter and gluten, in the form of starch, which starch is convertible to jelly or mucilage. This may be best effected without malting the grain.

We have seen that the process of malting is a vegetative degree of fermentation, which resolves the glutinous and unfolds the saccharine matter. This may be called the first stage of fermentation, in which the whole principles of the grain are uniformly blended.

The advantage obtained by malting, as already demonstrated, is the superior aptness or tendency of malted corn to ferment, over that which is unmalted.

To blend, with advantage, the saccharine and mucilaginous parts of the grain by the vinous fermentation into one homogenious fluid, called beer, ale, or wine, and dissipate, or throw off, the gluten, under the form of yeast lees, and lees, has been the object I have for years successfully laboured to accomplish, as well as to draw a greater length from the same quantity of materials than has been hitherto attainable.

With this previous knowledge of malting, and its subsequent influence on fermentation, we shall be better prepared to comprehend the usual appearance or interesting phenomena of this wonderful and instructing process, the decomposition of fermentable bodies.

A little attention to the doctrine laid down will, I hope, lead from things apparently obscure, to those that are more obvious, and from a rational theory to a judicious and successful practice. Wheresoever I introduce theory, it should be considered as a practical definition, resulting from the fullest experience; in order to demonstrate that experience by the most likely means of impressing it on the mind of the reader. The most simple things may require the most refined theory to explain them; the most obvious things frequently escaping our notice, perhaps from their being so. If there is nothing new under the Sun, all we can be expected to do, is to view old things in a new light. Though the principles, or the elements of all natural things are as old as the creation, their application to the purposes of mankind may be new, or we must be allowed to have arrived at our *ne plus ultra,* which I am pretty sure is not the case with the subject before us. If then, the application of these things are all that we may be able to boast of, as their nature remains the same, and that this application is perfectly new, it may be nevertheless useful, when applied to objects of so much importance as are manifestly the intention of these papers.

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The grand desideratum, to which all these and the subsequent observations and definitions tend, is the most certain road to profit, by improving the Doctrine of Fermentation, and the process of brewing and distilling; by obviating the influence the changes of the atmosphere has upon all fermented fluids in their progress to maturity, and the preservation of them afterwards, so as to prevent them turning sour, flat, or turbid, and for quickening their transparency, and recovering it when lost; at any time to bring malt liquors *forward*, as occasion requires; and to restore those which may suffer in any of these respects, by the neglect of the means pointed out, or for want of being possessed of these preventatives; and lastly by improving their flavour, quality, and strength; and for expediting the process of Brewing and Distilling, so as to save time and fuel in both, which may be occasionally helped by the structure of the apparatus, and mode of conducting the process in each; in which the volatile principle of the malt and hops may be saved in future to the brewer; and the most subtile and volatile part of the spirit in the process of distilling, and by which the purity, quality, and strength, are improved in spirits of the first and second extraction, and in every subsequent Rectification.

By accurately employing great part of the improvements in brewing here enumerated, to the Acetous Process of fermentation; a good gyle, rendered strong by my mode of concentrating its strength within itself, in the manner hereafter explained, lays the foundation of a good Vinegar, rendered still more strong by prosecuting similar means in the conducting the Acetous Process, to that recommended in the vinous process of fermentation; joined to the improvements contrived for the acetous only, will produce a most superior vinegar. The same, or similar means employed by the malt distiller, will be equally beneficial in the preparation of his Wash.

FERMENTATION.

Notwithstanding that the progress of improvement in the Doctrine of Fermentation has, in the last twenty years, much surpassed that which has been made in the processes of Distilling, yet much remains to be done; to the accomplishment of which, the thermometer and hydrometer has largely contributed, in enabling the malt distiller, brewer, vinegar-maker, &c. to see their way over the ground they formerly groped in a state of uncertainty; a proof that prejudices in this, as in other sciences, are giving way to improvement and the light of reason; the conviction of which must enlarge our ideas, and prepare the mind for the application of other instruments, and other means of improving those highly important branches of commercial chemistry, which every day are disentangling themselves from the prejudices, ignorance, and obstinacy, which, like a strong barrier, had hitherto opposed the light of reason and experiment.

Fermentation is the instrument or means which nature employs in the decomposition of vegetable and animal bodies, or reduction of them to their original elements or first principles. Fermentation is, therefore, a spontaneous separation of the component parts of these bodies, and is one of those processes which is conducted by nature for their resolution, and the combination and formation of other bodies out of them; therefore it is one of those operations in which nature is continually present, and going on before our eyes; this may be one reason that a very critical observance of it has escaped our attention.

Fermentation brings us acquainted with this unerring axiom, that nothing in nature is lost, or that matter, of which all things are composed, is indestructible. For instance, the vinous process of fermentation, succeeded by distillation, produces ardent spirit, or alcohol, the elements of which are here described; if we pass this alcohol, or spirit of wine, through a glass, porcelain, or metalic tube, heated red hot, provided with a suitable condenser, and apparatus to separate and contain the products, it will be decomposed, or resolved into its primitive elements, carbonic acid gas, or fixed air; and hydrogen gas, or inflammable air; the oxygen being decomposed and united with the oxygen, or vital air, into carbonic acid gas; the water of the spirit of wine being also decomposed, or resolved into its first principles, as herein stated, forms a part of the products before mentioned.

Hence, spontaneous fermentation, vinous, acetous, and putrefactive, is the natural decomposition of vegetable and animal matters; to which a certain degree of fluidity is necessary; for, where vegetable and animal substances are dry, as sugar and glue, for instance, and are kept so, no fermentation of any kind succeeds.

There can be no doubt, that spontaneous fermentation first taught mankind the means of procuring wine, and other agreeable beverage: observation and industry the way of making spirit and vinegar; the first of which is evidently the produce of art combined with the operations of nature.

With nature for our guide, and our own ingenuity, fermentation has been made subservient to the various products we now obtain from saccharine and fermentable matters, such as sugar, molasses, grain, &c. with which we have made wine, spirits, bread, beer, malt, &c. which last has much facilitated our practice in fermentation, but proved the tide-ending, or point of stagnation, to its further improvement, relying too much on malted corn.

In the operation of fermentation we are presented with some of the most pleasing and instructive phenomena of nature; the resolutions and combinations that are formed during the process of the vinous and acetous stages, are interesting beyond comparison to the brewer, malt and molasses distiller, vintager, cyder and vinegar maker, &c.

The elastic fluids and volatile principles that are extricated and escape, formerly so little attended to, are now better understood ; the method of commodiously saving, and advantageously applying them and other volatile products to the improvement of the fermenting and other fluids, will, I hope, not only form a new era in the process of fermenting, brewing, distilling, &c. but a new source of profit, that may in time lead to a recomposition of those elements from which they were produced, or at least the formation of vinous fluids, vinegar, spirit, &c. ; by resorting to the inexhaustible source supplied by nature of these important materials, and their application to the uses that may be made of that abundance so easily procurable, and at present so unprofitably wasted.

But to confine our views to the business immediately before us, let us begin with those aerial products, by stating that corbonic acid gas, or fixed air, is copiously extricated from fluids, in a state of vinous fermentation, and sundry mineral and vegetable substances, easily procurable, for which we have the testimony of our own senses ; the same may be said of hydrogen gas, oxygen gas, &c.

Presuming these positions granted, let us make a short enquiry into the composition of vinous fluids, &c. apprehending that there are but few people to whom these observations will be useful, but what will allow, that all vinous fluids, whether intended for beer, wine, cyder, &c. are the produce of saccharine or fermentable matter, obtained from the sugar-cane, grain, fruit, &c. and the part which art at present takes in this most beautiful process of nature, is to facilitate her operations in proportion to observation and experience, in conformity to the

the object in view, in making wine, beer, cyder, spirit, &c. or subsequent to the vinous, to forward the progress of the acetous fermentation for the production of vinegar.

The saccharine or fermentable matter of vegetables consists of what is chemically called hydrogen gas, or inflammable air, carbonic acid gas, or fixed air, oxygen gas, or vital air, which last forms nearly one third part of the whole atmosphere, circuminvolving our globe, in which we breath; or more exactly, 37 parts of oxygen and 73 of azotic gas, are the component parts of our atmosphere, except the small portion of undecomposed carbonic acid gas there may be found in it.

Beer, wine, cyder, malt, and molassas wash, and their product by distillation, spirit, consists of these three elastic fluids, or airs, in composition with various proportions of water. Water itself is a compound of vital and inflammable air; as a proof of this, and the indestructibility of matter, these two elastic fluids burned together in certain proportions, and in a proper apparatus, reproduce water. By another chemical process, this very water (or any other) is reducible to these two substances, vital and inflammable air; hence we see, that all saccharine and fermentable matter, and their products by fermentation, are composed of the same materials, and resolvable into the same elements.

It is scarcely necessary to give any definition of spontaneous fermentation after what has been said on the subject; if it was, I would say it is that tendency which all fermentable matter has to decomposition, attended with intestine motion, or ebullition, when sufficiently diluted with water, under a certain temperature of the atmosphere; the rapidity of which motion is always accompanied by an increase of temperature, or the change to a greater increase of heat, generated within the body of the fermenting fluid, in proportion to the rapidity, or augmentation of motion, or ebullition.

 Excited

Excited Fermentation, produced by the addition of yeast, or any suitable ferment, in a fluid duly prepared, is governed by the same laws, and under the same influence of temperature, except when it is accelerated or protracted by the management of the operator, or by changes induced by the influence of the atmosphere, rendered more or less subservient to his purposes; and produces a similar kind of spirit, by distillation, possessing in common the properties of vinous spirit: or is converted to vinegar by the subsequent process of acetous fermentation; but much more productive in quantity and quality, so as to answer commercial purposes.

In both spontaneous and excited fermentation, there is a similar escape of a large quantity of elastic fluid, or carbonic acid gas, with a considerable portion of spirit, and some of the water of the fermenting fluid. This gas is known to form a considerable part of mucilaginous substances, as sugar, molasses, honey, malt, and other saccharine and fermentable matter.

Although the doctrine of fermentation as a science does not enable us to alter the spontaneous course of nature, yet, if by the assistance of the instruments and means recommended, we are enabled to foresee and provide for the changes induced by the alterations of the atmosphere, we can guard against the inconveniences in some cases, and make them subservient to our purpose in others, so as more securely to conduct the process in each to advantage; and that with unusual facility, complex as it at present appears: it will not only be a great improvement in the present mode of fermentation, but facilitate our progress to greater improvements in the Doctrine of Fermentation.

Therefore, the rule of our conduct in these pursuits should be, to watch the operations of nature with the closest attention, and assist her when languid, and control her when too violent; that is, by spurring in one instance, and bridling in the other; and accurately and

undeviatingly

undeviatingly apply the means proposed in the manner recommended, until experience enables us to improve it; otherwise we shall only admire, without improving or profiting by her choisest phenomena.

The motions of the planets, perplexed and intricate as they must have appeared in the infancy of astronomy, are now calculated, and known with ease and precision.

ATTENUATION is a term, not unaptly applied to FERMENTATION, the property of attenuation being to divide, thin, dilute, and rarefy, thick, gross, viscid, and dense substances, in which some degree of fluidity is pre-supposed: it is, therefore, that kind of dilution or fluidity which is promoted by agitation, and very aptly applied to mark the progress of fermentation, which is itself the process of nature for decomposing vegetable and animal substances under a convenient degree of fluidity; it exists in intestine motion, either spontaneous or excited, accompanied with heat, which, under certain limits, is proportioned to the vigour of the fermentation, which ends in the decomposition of one class of bodies, and the composition of another, and which may be instanced in the resolving saccharine and fermentable substances into hydrogen, oxygen, and carbon, and the combining them into inflammable spirits, or alcohol, and uninflammable acids, or vinegar. To which may be added, the lower you attenuate, the lighter and more spirituous the fermenting fluid becomes; and that attenuation which is the offspring of fermentation, like the parent process, has its bounds, and can only be conducted with certainty and advantage by the use of the hydrometer, thermometer, &c. In this only lays the difference between the old word Fermentation, and the new word Attenuation.—Every thing used as a ferment, or to promote fermentation, is attenuant.

The tendency of the vinous process of fermentation is to evolve, or disentangle the hydrogen of the fermenting fluid, and unite it with the

the carbon and oxygen of the same fluid into ardent spirit, wine, beer, or alcohol, which last is well known to be inflammable. The tendency of the acetous process of fermentation, is to involve or entangle the hydrogen and carbon of the fermented fluid with a greater portion of oxygen into vinegar, which is uninflammable. The fixed air, or carbonic acid gas, so abundantly extricated during the vinous process of fermentation, which every one concerned in the process are presumed to be acquainted with, is either composed of hydrogen and oxygen, or is a composition of carbon and oxygen, on which philosophers are divided in opinion. As the result is the same with respect to the formation of wine, beer, and spirit, I shall enter into no controversial reasoning on this head; instead of which, I shall endeavour to point out the most effectual mode of saving and profitably applying it, and the other elements in the composition of wine, beer, spirit, and acid, referring a further definition to another place.

As in fermentation, spontaneous or excited, there is a sensible escape of carbonic acid gas, or fixed air, it may not be improper to note, that fermentable or saccharine matter consists of about twenty-eight pounds of carbon, eight pounds of hydrogen, and sixty-four pounds of oxygen, reducible into fixed, inflammable, and vital air, weighing one hundred subtile pounds in toto, or that every one hundred subtile pounds of saccharine matter consists of such proportions of these airs, or gases.

Attenuation is the result of a due resolution of the fermentable matter produced by excited fermentation, which divides mucilages, resolves viscidities, breaks down cohesions, generates heat and motion, extricates the imprisoned gases, and by frequent commixture promotes the action and re-action of the component particles on each other, and by continually exposing a fresh surface and opposition of matter, brings them within the sphere of each other's attraction.

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As their original attraction is weakened by heat and motion, their expansion is increased by repulsion; and, as they *evolve* and recede from each other in this way, they are fitted by the change in their modification to *involve* each other, and form new attractions, combining with each other into new substances, according to affinity, under changes induced in their nature conducive to this end, which, not being exactly known, cannot at present be fully defined.

In every brewing, or preparation, of a saccharine fluid for fermentation, the following phenomena occur: first, *heat* is either disengaged or fixed; secondly, an *elastic fluid* is either formed or absorbed in a nascent state: these two indisputable facts form the uniform and invariable phenomena of fermentation, and may be admitted as an established *axiom*; and that the proportions, extrication, and action of heat, with the formation and fixation of elastic fluids during the process, are the foundation of the vinous products of the fermenting fluid.

In conformity to so rational a theory, I have for many years regulated my practice, the result of which is the object of these papers. These, therefore, are the three great objects which should engage our attention, not only in fermentation, but in every similar process in chemistry, and are the fundamental principles of our doctrine.

Fermentation being not only a decomposition of the fermentable matter, but of the water of the fluid also; and the fixed air formed during the process being composed of the hydrogen and oxygen of the fermentable matter and the water of the fluid also, there is a perpetual decomposition and recomposition of that water which gives fluidity to the whole mass, taking place during the continuance of the process, part of the hydrogen and oxygen of which escapes under the form of fixed air, for want of a proper substance being presented, of affinity enough to absorb and combine with it into wine, beer, or spirit.

Or

Or some other necessary assistance in heat, light, motion, oxygen, hydrogen, carbon, &c. or an intermedium, to facilitate the formation of wine, beer, or spirit, in preference to fixed air. Fixed air, or carbonic acid gas, consists of about twenty-five parts of oxygen, and nine of carbon, divested of the mucilage and yeast that rises with it.

It should be recollected, that the decomposition of pyrites, the formation of nitre, respiration, fermentation, &c. are low degrees of combustion; and though it is the property of combustion to form fixed and phlogisticated airs, both the modes of doing it, and the quantity of the products, depend on the manner of oxygenating them, in the changes brought about by the different mode of eombustion or fermentation in the vinous, acetous, and putrid process, which shew the affinity between them.

Fermentation is a subsequent *Low Combustion* of the vegetable oxydes, or grain, that has undergone a previous but partial combustion, something like the slightly charing or oxydating of wood or pit-coal, by which the oxygenation is incomplete in both, and rendered more complete in the former; an ultimate combustion of the fermentable matter employed is found only in the putrid process of fermentation, which is a final or total decomposition of vegetable and animal substances in the actual combustion or burning of wood, charcoal, or bones.

In the vinous process we have seen the escape of carbonic acid gas; in the acetous process there is a great escape of azotic gas, or phlogisticated air, from the decomposition of the air of the atmosphere consumed in this process, which consists of about two-thirds of azotic gas, and one-third of oxygen gas *, the oxygenous part being absorbed in the acetous process, and the azotic set free, with more or less hydrogen and acetic gas, proportioned to the existing heat. If the

* Twenty-seven parts of oxygen gas, and seventy-three of azotic gas.

the heat is beyond a certain degree, a portion of the etherial part of the new formed acid escapes also.

In the putrid process the hydrogen escapes under the aeriform shape of inflammable air, and azotic gas, and nothing more remains than mere earth or water, or both, as the case may be, which is exactly similar to other combustions, of which nothing remains (if we except phosphorus) but earth or ashes, with what small portion of alkaline or other salts they may contain. This alkaline matter being present during the formation of carbonic and azotic gas, absorbs to saturation a due proportion of them, and generates *Tartar*.

Experience has taught us the truth or justness of this definition, and though it has brought us acquainted with the results of these three stages of fermentation, combustion, or decomposition, we have certainly overlooked the means of applying them with all the advantage they admit of, in the business which is the subject of these papers, and which a little time and closer observation must convince us of, and of how much has been hitherto lost, with the means of saving it in future, as shall be presently explained, and particularly pointed out.

In the prosecution of this design, where I may not be able to give an unexceptional demonstration, I hope always to be provided with a practical proof, which may prove equally beneficial.

Let us now see what passes in a state of Low Combustion, such as for instance may be the result of fermentation in vegetables, arising from heat, moisture, and motion, when impacted together: the most obvious occurrence of this nature is found in new hay, which, under these circumstances, for want of care and attention, often spontaneously takes fire, particularly in wet seasons.

Fermentation being one of the lowest degrees of combustion, is here the spontaneous effect of the moist hay being impacted together, and not properly made, that is, without the superfluous juices being dried out of it, by which it retains a sufficient degree of fluidity or moisture to begin a fermentation, in which heat and motion are generated, and light in a nascent state extricated ; these appearances accumulated and accelerated by incumbent pressure, the redundant moisture being soon exhausted, and the heat and motion increasing, the actual combustion of the mass takes place, which is much facilitated by a decomposition of the water of this moisture, and the air of the atmosphere unavoibably insinuated between the interstices formed by the fibres of the hay, as they are impacted together into cocks, or stacks, and it breaks out into actual flame, or *light visible.*

These are no novel appearances, but such as fall within the observation of every one; and the candid malster will acknowledge, that from the same cause, though differently produced, similar effects may, and sometimes do happen in the malt house, in the preparation of that modern article of luxury, by which we are enabled to make malt wine ; and these instances are sufficient to prove fermentation to be a low degree of combustion, and to both simplify and explain the justness of this doctrine. The malting of corn is the first stage of vegetation, low combustion, and fermentation.

From observation and reasoning on what passes before our eyes, we discover the low species of fermentation, in which the malting of corn consists, to be a low degree of combustion, which for want of due attention, may break out into actual flame. We were always acquainted with the *effect* ; now reasoning on the subject brings us to a knowledge of the *cause.*

To any one at all acquainted with the nature of fermentation it must be manifest, that the malt distillers have paid more attention, and made

made greater progress in the improvement of the process, than any other class of men interested in the success of it; though far from having arrived at their *ne plus ultra*.

The introduction of raw or unmalted corn, the close compactness of their working tun, or fermenting backs; the order and progressive succession with which they conduct the process, and the scrupulously close attention they pay to pitching their backs at the commencement of that process, and the pains they necessarily take to arrive at a perfect attenuation, by a long protracted fermentation, with the early conviction of a reward proportioned to their diligence and the success attending their best endeavours, when not frustrated by intervening causes, must be stronger inducements with them to delight in this instructive process of nature's formation, than with the brewer, who has not these immediate tests to encourage his labours, which the others daily derive from distillation, and which so quickly and uniformly terminates their hazards and success. The principal object in their view being a high and deliberate attenuation, with a full vinosity, without a further regard to the quality or flavour of their wash, as the combination of these qualities alone produces the required strength, in the *cleanest* manner the fetters of excise will admit.

The Brewer's cares are many, and of longer duration; He is the Vintager of our Northern Climates: His porter or ale must be an agreeable malt wine, suited to the palate of the district or neighbourhood he lives in, or ultimately to the taste of his customers. The time he has allotted himself for attenuation was first founded in error derived from an ignorance of the subject, and slavishly continued by that invincible tyrant, custom. Hurry marks the progress of his fermentation, which can only be corrected by his speedy mode of *Cleansing*, and the consequent but unnecessary perishing of a part. He must begin with more accuracy at the mash tun than the malt distiller, as it is there he must not only regulate the strength, but partially the

flavour and transparency of his malt wine. His object does not end with the malt distiller's, nor, like his, concenter in one focal point, the solution of the whole of the farina of the plant or grain employed, regardless of milkiness or transparency; he must carefully take the heats of his liquor, so as to solve and combine the qualities he has in view; which, if he misses in the first mash, are partly irremediable in the succeeding ones. His cares do not end here; independent of the minutia of fermentation and cleansing, he has the flavour, FINING AND BRINGING FORWARD of his MALT WINES, nearly as much as the strength, to consider, and employ his attention.

It will scarcely be supposed that I would make these observations merely with a view of drawing this comparison, though even it might throw some light on the subject, without an attempt at supplying the defects pointed out, and remedying the evils represented.

When the carbonic acid gas, or fixed air, so often mentioned in these papers, may be rendered subservient to part of the improvements I have in view, and which is the constant, abundant, and uniform result of low combustion, or vinous fermentation, in proportion of thirty-five pounds weight to every hundred of saccharine or fermentable matter, fermented in a due proportion of liquor or water, from the decomposition of which last, and the absorption of its oxygen, it is principally obtained.

We have previously seen, that one hundred pounds of fermentable matter consists of eight pounds of hydrogen, twenty-eight of carbon, and sixty-four pounds of oxygen; we have also seen, that about thirty-five pounds of carbon is extricated and detached from this quantity of fermentable matter, properly diluted in water during fermentation; allowing the usual quantity of spirit at the same time to be formed by the process, this superfluous carbon (as it now appears) must come principally from that decomposition of the water of dilution,

tion, and not from the saccharine matter employed, which contains altogether but twenty-eight pounds of carbon, the whole of which must necessarily go to the formation of the fifty-seven pounds of dry alcohol produced.

But not to descend too deeply into particulars that might lead into discussions not absolutely necessary in this place, let us take the produce of ten gallons of ardent spirit, at one to ten over proof. We here find that much more carbon has been generated and given to the atmosphere than went to the composition of this quantity of spirit, independent of the large quantity of alcohol dissolved in, and carried off by it, in its flight, as before observed.

Allowing the average quantity of fermentable matter in a quarter of malt, barley, or other grain, to be only seventy-five pounds, then four quarters will be equal to three hundred subtile pounds of raw sugar; or eighty quarters of the one will be equal to sixty hundred pounds of the other, or three tons weight of unadulterated molasses.

If we estimate the superfluous carbonic acid gas of this quantity of materials at only twenty-eight pounds per hundred, that will be fifteen hundred pounds dissipated during the fermentation, which, from experiments both analytical and synthetical, hereafter to be recounted, cannot possibly carry off less than three hundred and seventy-five pounds of strong alcohol, equal to double that quantity of ardent spirit at hydrometer proof; which is a loss on every brewing of this quantity of materials, of upwards of forty-one gallons of spirit of the strength of one to ten.

What is computed here in spirit may be easily applied to wine, porter, ale, sweets, &c. in barrels, allowing three gallons and three quarts of spirit per barrel to the former, and four gallons per barrel to the latter, which

which gives eleven barrels and three quarters of the one, and ten barrels and a quarter of the other, lost on each brewing of eighty quarters of malt, or the average of that quantity of other materials, by the *mismanagement* of the *fermentation* in one point only.

It must appear evident to every person capable of investigating this calculation, that every six or seven pounds of corbon, fixed upon each quarter of malt or other materials, there will be an augmentation of gravity or strength on this number of quarters of ten or twelve barrels each brewing: that is, every six or seven pounds of this fugitive carbon, that we arrest and fix in the fermenting fluid, as a component part of the subsequent produce, by presenting the requisite portion of oxygen and hydrogen for the purpose within the sphere of each other's attraction, we increase our strength in the beforementioned *ratio*.

This may be most effectually accomplished by my Pneumatic Apparatus, by means both previously and hereafter described, either to the extent mentioned, or to any proposed extent within the range of the fugitive quantity; and with scarcely any addition, to the extent of ten or twelve barrels each brewing.

It is but of little moment whether this redundant gas comes from the water of dilution, or from the fermentable matter, as under, if we can by any means turn it to account.

We have presumed the average quantity of fermentable matter at seventy-five pounds per quarter; this must be evidently upon the best goods; this will give us a length of three barrels per quarter, of twenty-five pounds per barrel, specific gravity. Suppose the apparent attenuation of these goods nineteen pounds, the transparent gravity will be six pounds per barrel, viz.

Gravity

Gravity of the Worts in the cooler, just before letting down into the gyle-tun, per Barrel — — —		25lb.
Apparent Attenuation, per Barrel — —	19lb.	
Transparent Gravity, per Barrel — —	6lb.	
		25lb.
Or take it as it really is, viz. Specific Gravity, per Barrel —		25lb.
Real Attenuation, per Barrel — —	13lb. 8 oz.	
Yeast and Lees — — — —	5lb. 8 oz.	
Apparent Attenuation, per Barrel — —		19lb.
Gravity, per Barrel, when transparent — — —		6lb.
	Total	25lb.

It may be said, that nineteen pounds is the real attenuation, and the yeast and lees produced is part thereof, as the fluid, or beer, in a state of transparency is but six pounds per barrel, specific gravity; and it may in some degree be allowed to be so, as there is really so much gravity lost during the process of fermentation.

If we multiply thirteen pounds eight ounces, which I have called the real Attenuation, by four, we shall find the result to be fifty-four pounds, which is nineteen pounds more of superfluous gas, upon four barrels of worts of twenty-five pounds gravity each, than is extricated from an equivalent quantity of saccharine matter; that is, from one hundred pounds of raw sugar, or one hundred and twelve pounds of molasses, and their respective water of dilution, when the yeast and lees do not exceed five pounds eight ounces per barrel. This may be truly called an analysis of the fermentable matter, giving the component parts tolerably exact, though much depends on the management of the fermentation and the subsequent cleansing.

By

By this analysis it appears, that the mucilage of malt, or grain, gives out more gas than the mucilage of sugar; and leaves a doubt on the mind whether to adjudge the superfluous gas to the fermentable matter, or to the water of dilution, or partly to both; but so it is, that these are the products, whatever source we derive them from, and there is no denying facts. The yeast first added is not brought into this account.

There is a great similarity of appearance between the two species of Low Combustion, Fermentation and Respiration; fermentation, like respiration, is the spontaneous effort of involuntary motion to decomposition;--and in the fermenting mass, as in the animal system, it raises the temperature of both above that of the surrounding atmosphere; that is, it is the cause of heat and involuntary motion, both in the fermenting mass and in the animal system; and, like Slow Combustion, consumes both, and resolves them into their first principles, from which tendency the latter is constantly withheld by the ingesta, fuel, or food, thrown in. I am well aware I must not carry this reasoning any further!

Deep investigation may be thought not to be the object of our research; but we must always have two things in view in enquiries of this nature; indeed, in every pursuit of useful knowledge, where, like the present, it is connected with first principles, to pursue the winding path of nature through all her meanderings, up to the ultimate source of those elements which are the instruments of her operations; and, when we are favoured with a knowledge of these, either as the reward of laboured assiduity and attention, or the result of chance, to copy the original as close as we can.

I know I shall be justly accused with tautology. I must plead guilty to the charge, not having leisure to apply the pruning hook of correction.

The

The misfortune is, that new doctrines must appear in a new dress, by which they wear the garb of novelty, though with respect to first principles there is nothing new under the sun. Yet the application of these principles might have remained in oblivion for ever, if not called into action. The man who in any age calls them into action, and beneficially applies them for the good of that community of which he is a member, may be virtually, though not literally, called the discoverer of a principle. The man that projects, and the man that executes, a voyage of discovery, have superior claims to the man at the mast-head, who first cries out land.

The new turn that the discoveries of modern philosophers have given to natural philosophy requiring a change of names as well as system, unusual words are unavoidably introduced to express new terms of science, that gives a different character and fashion to the whole, that I should have great pleasure in avoiding were it possible, which it obviously is not, finding it easier to glide down the stream than oppose its torrent.

Notwithstanding that I have calculated upon nineteen pounds only of twenty-five pounds per barrel of fermentable matter being attenuated, and have even in that quantity included five pounds eight ounces of lees and yeast, (the least quantity produced) such calculation must not be admitted to preclude the practibility of attenuating almost every particle of fermentable matter, and replacing it with an equivalent particle of spirit, if that spirit which is now carried off by the avolation of the fixed air, is, agreeably to my proposal, either arrested in its flight, or filtered after its escape from the gyle-tun and cleansing vat by the proper apparatus.

Having in a former part of these papers observed, that attenuation may be carried too far, it may be necessary for me to reconcile these seemingly opposite positions, which should be understood in this

way. When the quantity of fermentable matter suspended in a barrel of worts intended for beer or ale, is from five to ten pounds more than twenty-five pounds per barrel, every particle of it may be safely attenuated, as the quantity of spirit generated will be sufficient to preserve the beer or ale for any requisite length of time, provided it has been properly hopped, &c. or in lieu thereof received certain other additions to improve its vinosity, strength, and keeping.

When the quantity of fermentable matter in worts is from five to fifteen pounds per barrel less than twenty-five pounds, the height of the attenuation ought to be limitted on keeping beer and ale, the spirit generated being insufficient to preserve so much fermented fluid in a drinkable state for any length of time, with the usual additions only, even during the summer heats of our own climate, and if so, totally unfit for either exportation to warm latitudes, or for keeping at home.

For the right understanding of these observations, we should consider that the unattenuated fermentable matter is perpetually furnishing a gradual supply of fixed air and spirit, by means of the imperceptible fermentation always going on in vinous liquors.

Weak beers and ales fret and spoil very soon in warm weather, which proceeds from the development and avolation of their fixed air; strong beers and ales have their limits under the same influence of heat, time, changes of the atmosphere, &c. and owe their preservation to two things, that is, to a due proportion of fermentable matter unattenuated, or the quantity of spirit they contain; as under these circumstances they are either preserved by the spirit already formed, or that continually supplied by the spontaneous decomposition of the fermentable matter they contain, slowly developing and yielding a a fresh supply of air and spirit; hence beers and ales not too highly attenuated, derive strength and spirituosity from age, when properly

stored

stored or cellared, and duly secured from the changes of the atmosphere.

These observations are applicable to Sweets or made Wines, and to those which are the produce of the grape; the progress of fermentation and attenuation being (or ought to be) interrupted in them by racking off, which is similar to cleansing in beers and ales: and in Madeiras and other dry wines, the incipient acidity is corrected and restrained by proper additions, introduced in the early part of the process, and with others of similar effect when the wines are making up, either for use or exportation, as may be seen at full length in the Appendix.

We may gather from these observations, that Worts, attenuated for beer or ale, to the decomposition of all their fermentable matter, that is, attenuated so high, or so low, that their specific gravity is reduced to the standard of common water, and from that to the degree of levity spirit is known to give to water, in the proportion to the quantity added; and left to the preservation of the spirit formed, they have little or no auxiliary assistance from their original products already exhausted by the highest or completest attenuation obtainable. An important circumstance always to be attended to, particularly by those who affect an unnecessarily high attenuation!

The intelligent brewer may, by the assistance of these observations, form a most accurate rule for the regulation of his future conduct in the management of fermentation, according as his beer or ale is to be weak or strong, or for present use or long keeping, for the accomplishment of which, the use of the hydrometer and thermometer claim his peculiar attention, and will undoubtedly answer his expectations, when joined to the certainty he is now at, of knowing when he is, or is not, to expect the development of fixed air and additional spirit, by which he can govern himself accordingly.

These observations lead to a removal of the difficulties that lay in the way, and at the same time suggest a mode of applying the present, or of constructing a future *Hydrometer*, for ascertaining the strength or the quantity of the vinous spirit, in beer, wine, ale, and other fermented fluids, which has long been a desirable object.

The distiller, having none of these niceties to attend to, is governed by the ultimate extent of that attenuation the worts or wash is found capable of, and which is both assisted and protracted by its superior density, in its progress from specific gravity to specific levity, if such an expression is admissible.

Fermentation begun in a fluid more or less saturated with saccharine or fermentable matter, the process is finished sooner or later, and usually in proportion to the degree of saturation, and the being conducted with more or less vigour, under a well regulated temperature; for the more a fluid abounds with this matter, the grosser and denser it must necessarily be, and the longer will the attenuation be protracted; the longer it is protracted in air-tight vessels and in a healthy or vigorous state of decomposition, the more spirituous and stronger will that wash turn out, and the greater the produce of spirit in distillation; hence it is both assisted and protracted by its density.

A languid may be truly called an unhealthy decomposition, it being productive of diseases common to misconducted fermentation, acidity, putridity, and lack of spirits, with a tendency to precipitate and burn upon the bottom of the still; hence all the decompositions are confounded together as in spontaneous fermentation.

The formation of acidity during the process, is not of that injury to the distiller, that it is to the brewer, nor is this recent acidity vinegar, as has been supposed by some good chemist,* but the incipient

* Lavoisier.

cipient state of the combination of resolving elements, whose particles are in that juxta-position best suited to absorb, developing hydrogen in a nascent state, and intimately to combine with it into vinous spirit, the approximation to which is promoted by time and incumbent pressure. These positions shall be beneficially explained in the course of these papers.

The reason that putridity is so rarely discovered in excited fermentation, is, that it is usually counteracted by the previously evolved acidity and corrected, but not saturated or neutralized; for were that the case the putrid could not immediately succeed the acetous process in the same fluid, nor exist together, as they are known to do in declining beer, vinegar, &c.

The reason that acidity is not more frequently observed and attended to than it is, is because of its being sheathed or covered by the unattenuated sweets, or fermentable matter of the wash that remains undecomposed.

On the other hand, when acidity is very prevalent, it may be mistaken for unattenuated fermentable matter, acidity increasing the density and specific gravity of the fluid.

Putridity, from the avolation of its products, promotes levity, and that in proportion as its increase surpasses that of the generated acid, and it is not until the action of the acetous becomes languid, that the putrid process gains the ascendency, when it is then difficult to overcome.

Although these observations may shew how the hydrometer or its use in unexperienced hands may be baffled, they both distinguish and explain the value of its application: they do more, they elucidate the Doctrine of Fermentation, and illustrate the goodness of that pro-

vidence who has made nothing in vain, but provided nature with its own resources for conducting every operation in the great plan of the universe with uniform and unerring security.

In the decomposition of fermentable matter, either by combustion or fermentation, (which I have defined to be synonimous) a portion of inflammable air or hydrogen is first evolved; secondly, another portion of inflammable air united with pure air, or oxygen gas, evolves under the form of fixed air; this is the constant and uniform phenomena of these decompositions, and are progressively going on from the beginning to the end of the fermentation, while there is any fermentable matter to attenuate. A due portion of oxygen uniting in a nascent state, with a correspondent portion of inflammable or hydrogen, and fixed air, forms the spirituous particles dispersed through the fermenting fluid, which create vinosity and constitute it wine, beer, or wash.

During which, so great is the avolation of fixed air, (as we have seen) that much of the etherial part of the new formed, or rather the scarcely formed spirit is carried off with it in a gasseous state. This is much assisted by the agency of the atmosphere, which is the solvent and receptical of etherial products, whose affinity for them must be as great as it is perfect and immediate, which demonstrates the necessity of having air-tight vats. When we consider the composition of the atmosphere, and that it owes its formation and existence to this cause, and thereby becomes the menstruum of all created matter, we may be better able to understand the composition and formation of vinous spirits, and by closely copyiny the original, more successfully imitate nature.

We have seen that the principal phenomena in fermenting fluids is a brisk intestine motion of their parts excited in all directions, with a loss of transparency or a muddiness, a hissing noise, the generating of a gentle

gentle heat, and an exhalation of gas. This heat we must now observe is always very sensible before the extrication of any gas.

We have adverted to the similarity existing between respiration and fermentation, which is remarkably so in the equality of heat produced in both, in a healthy state of either, and which seldom exceeds ninety-six degrees of Farenheit's thermometer; but there are instances of their being much higher in both, without producing much injury to either. Instances of this could be adduced at home, without referring to the warmer climates of the East and West Indies, where the temperature of the atmosphere is so much higher than with us; and that the temperature of the fermenting fluid, when at its height, always exceeds that of the surrounding atmosphere in these latitudes, which makes the similarity still stronger between these two decomposing processes. This is a general and just remark; but in order to regulate it by practical facts, we must name the medium standard of heat, which rarely exceeds eighty-five degrees with the brewers; this is the medium of seventy-four and ninety-six degrees; but the medium heat is not unfrequently up to ninety-six degrees in the distillers' fermenting backs of these kingdoms. Much depends on the degree of temperature the fermentation is pitched at; here nothing is spoken of, but the cleansing heat with the brewers, and the meridian heat with the distillers.

For the maintenance of combustion, the free access of air being necessary, an objection may be raised to air-tight vats, as unfit to carry on this process in, to the exclusion of external air, which objection may seem to gather force from the compression it occasions of the fixed air on the decomposing fluid, which is allowed to extinguish Active Combustion. I must acknowledge these are formidable objections to my definition of Low Combustion; but I by no means find them unanswerable.

The

The aptitude of new hay, malt, and other vegetable matters, to spontaneous combustion, when impacted together under incumbent pressure, and a certain degree of moisture, should be recollected; and that this tendency is not destroyed by excluding the admission of external air, but by quickly dividing and cooling the impacted hay.

The great quantity of oxygen, or vital air, both in the water of dilution, and in the fermentable matter, with which the fluid is more or less saturated, should be also recollected, which is about eighty-five parts in the former, and sixty-four parts of one hundred in the latter.

Though in an unelastic or fixed state, it is one of the properties of combustion to disengage and render it elastic, great part of which, during the low combustion which it supports, and in which heat is visible or perceptible, and light in an invisible state developed; three-parts of this oxygen, with about one-third of its weight of carbon, is converted to an elastic state under the form of fixed air, that separates from the decomposing mass; a circumstance attending also on the combustion of coal, and other combustable substances during their decomposition by that process, which is supported in them by the external air of the atmosphere, where heat and light are both visible from the intensity and velocity of the combustion; and wholly invisible in the former, not from exclusion of external air, but from the length of time elapsed in low combustion; the one being performed instantaneously, and the other taking several days from its decomposition.

Although fixed air is known to extinguish a lighted candle, and suffocate mice, &c. *, that is, to be equally unfit for the combustion of inflammable bodies, or the support of animal respiration; it is also known to be as successfully employed as atmospheric air, or even dephlogisticated,

* Priestly on Air.

dephlogisticated air, to melt glass, &c. when applied to the clear flame of a wax-candle, by passing a current of it through a blow-pipe to direct that flame on the glass to be melted.*

This will not be so much to be wondered at, when we consider, that the proportion of vital air in fixed air is as twenty-seven to nine; and in atmospheric air, the proportion of azötic gas, or phlogisticated air, to vital air, is as seventy-three to twenty-seven; therefore the former contains three-fourths of vital air, and the latter little better than one-fourth; but the fixed air, is in a combined, and the phlogisticated air, in an uncombined state.

Among the processes made choice of by nature for the decomposition of vegetable and animal substances, Fermentation, or Low Combustion is a principal one. Air, in a fixed or unelastic state, may be as necessary here, as air in an elastic state is known to be in the active combustion of inflammable bodies.

Chemists and philosophers are no strangers to two sorts of combustion, one in external air, and the other in close vessels.

But this is not the combustion alluded to in fermentation, where all the requisites for a complete decomposition is to be found, independent of contact with the atmosphere; here one part is oxygenated at the expence of the other, and the other disoxygenated in favour of it.

Nor does the solution, or decomposition, of metals by acids, the combustion of inflammable and vital air for the production of water, stand in need of external heat or fire, any more than the low combustion in which fermentation consists for the production of spirit,

 beer,

* Count Rumford, on the Economy of Fuel.

beer, or wine, than that generated by the self-operation of its own temperature.

Similar to this is the self-animating principle or power with which nature has endowed the animal body of generating its own heat by respiration.

In Fermentation, the caloric, or matter of heat, which is plentifully disengaged by the condension of oxygen, is prevented from breaking out into flame with the condensing hydrogen, from the presence of affinities in the fermenting mass, ready to absorb and fix them into vinous spirit, ale, beer, &c. with the other component element, carbon; by which they are too instantaneously taken up and fixed, to amount to more than bare ebullition, and pass at once from an incipient state of elasticity, to a fixed and non-elastic one; while the redundant heat, which would otherwise appear, is taken up and carried off by the abundant formation of carbonic acid gas; which requires so great a quantity of caloric to render it permanently elastic, as not only keeps this sort of combustion under ignition, but much below the degree of heat at which the accumulating vinous spirit could be raised to the evaporable or distilling point, though capable, as already observed, of detaching a considerable portion of it with the volatile gas, and of the water of solution, or the water of composition recently formed from the present attractions in its most volatile and incipient state of formation, both which we have seen ascend with the fixed air extricated, partly in a combined, and partly in an uncombined state.

One part of hydrogen is sufficient to saturate and fix above five of carbon, and they require nearly sixteen parts of oxygen to complete their formation into alcohol, while the water of dilution undergoes a proportionate decomposition, and recomposition to assist the resolu-

tions

tions and combinations present, and support the admirable equilibrium preserved by nature.

At the same time that the extreme levity of the hydrogen gas accounts for the great quantity of heat which it holds in combination, and the high temperature requisite to effect its decomposition, and that such is its capacity for heat, that though combined with oxygen and water, it still possesses the property of absorbing a great deal more; it is this property which renders aqueous vapour lighter than atmospheric air in which it ascends, as I have elsewhere shewn. On which principle I have constructed my condensers, or refrigiratories, for facilitating the process of distilling, which may be seen in the Second Part of this Work, under the *Description of Utensils, &c.* Yet we have just now demonstrated the resolution and combination of hydrogen gas, and oxygen gas, both extricated from the fermentable matter and the water of dilution, and their formation into spirit, &c. at a temperature not many degrees above that of the incumbent atmosphere, and no higher than that excited by respiration in the animal system.

In which we have shewn the vegetable oxyde, (saccharine matter) when reduced by the admixture of water, to form the Worts or Wash, to be a carbonated hydrogenous fluid, containing the elements of wine, beer, ale, spirit, &c. and the mode of producing them under circumstances conducive to their formation; these are motion, heat, pressure, and mutual attraction, called into existence by a species of low combustion, or fermentation, somewhat similar to respiration.

In which the materials, the products, and the liberation of caloric, are ultimately the same, whether the operation is attended by visible fire from the velocity of action, or weak incalessence from the slow progression of its motion; in which the component elements are continually assuming a gasseous form, and as constantly loosing it by the

force of mutual attraction for each other. No sooner is the equilibrium broken in one instance by their gasseous appearance, than it is restored in another by their condensation, and the heat liberated by the latter, taken up by the former, by which the equilibrium is preserved. In this consists the increase of temperature above that of the surrounding atmosphere, accompanied by the discharge of fixed air; to fix, and advantageously apply which, shall be the next consideration; and by an accurate imitation of the modification employed by nature, to render the fermenting fluid so much the stronger by such fixation.

To accomplish which, we must advert to what has been delivered in the preceding papers, particularly to the proportions in which the equilibrium preserved by nature consists, and exactly to her manner of combining them in sugar, malt, and other saccharine matter, her mode of breaking this equilibrium, or decomposing them by fermentation, and recombining them into wine, beer, &c. and by the same process restoring the equilibrium.

Happily the *Intermediums* to be successfully and beneficially employed, are sufficiently abundant, and infinitely cheaper than the original materials, sugar, molasses, malt, grain, &c.; and the mode of operating far from expensive, in time, utensils, or any other accompanyment; so that nothing lays in the way of completion, succeeded by perfection, than a happy structure of the instruments or apparatus with which these operations are to be performed, commonly called utensils.

Notwithstanding a practical acquaintance with chemistry for upwards of thirty years upon a very large scale, during which, not only the notion, but frequent opportunities to realize these improvements, have occurred to me, yet I am not so inflated with opinion, though confident of success, but that I should readily accept the auxiliary aid of ingenious men, in the structure, and probably the improvement,

improvement, of my apparatus, for effecting the desirable objects I have in view, on the liberal terms of fellow labourers in the field of science and mechanics, and mutual advantage; with such men I shall always be found ready to treat, particularly with those disposed to put their hand to the oar one way or other, which, in my opinion, should always be the case with persons embarked in one bottom.

The intelligent reader, from a review of these papers, will easily conceive, that those resolutions and combinations are but very slenderly connected with the producing substances in a gasseous state, but principally depend upon union in a nascent, or gasseous incipient state, the gasseous being too fugitive, for either a complete or advantageous combination, notwithstanding such part of the fixed air, or fermenting fluids, as elude the vigilance of the inexperienced operator, and escape the arresting intermedium, shall be beneficially applied to useful purposes, and the vinous spirit it contains, which was lost by the old, saved by the new process.

It cannot be doubted, but that in the investigation of the acetous process of fermentation, with the attention we do the vinous, they will mutually reflect light on each other; in which it will come out, that wine, beer, ale, vinegar, spirit, &c. are not the only commercial preparation to which the Doctrine of Fermentation, or Low Combustion, may be advantageously applied, but also to others, that are perhaps equally important and productive.

The *Cleansing* being at the meridian, or greatest temperature, of the heat, of the Fermenting fluid, and the object of that cleansing being to reduce the heat, and thereby allay the violence of the fermentation, by which an immediate decomposition takes place, the lighter impurities buoyed up to the top of the fluid flow off with the Yeast, while the heavier dregs descend to the bottom, and the fermentation gradually declines, as the cleansing draws to a conclusion, and

and the fermenting fluid forms a turbid heterogenous mass, very perceptibly approaching towards a transparent homogeneous fluid in its progress to a drinkable state.

In laying out a *Brewing Office,* the air should have free access to the coolers on all sides, under and over. Cleansing vessels should be similarly situated, and if avoidable, the coolers should not lay immediately over them, to raise their temperature, which should not be many degrees above that of the atmosphere at temperate, which is fifty-two degrees; but the descent from the cleansing heat (seventy-five to eighty-five) should be progressive, that is, not sudden. A sudden chill would precipitate the grosser, and diffuse the lighter dregs, throughout the fermenting fluid, which should be thrown off from the surface in cleansing; this would retard the fining, and impoverish the beer or ale, while the mode recommended will be found to promote transparency, and give strength and body, that is, fullness and spirituosity. Still attemperators would be necessary, but infinitely more so where these precautions have not, or could not be taken.

In general, the cleansing commences too soon for the strength and quality of the goods, particularly for *Porter,* since the introduction of a greater portion of pale malt than formerly used, a more perfect fermentation is now requisite to keep up the genuine distinction in the flavour of porter from ordinary beers, and ales, which, since the change of *lengths,* has much declined, though the only characteristic quality that gives it merit over other malt liquors. An object that deserves consideration in this great commercial branch of trade and source of national wealth, where the loss of distinction will be the loss of trade. The rough, astringent, thirst-creating, smak is the produce of the browner malt, and a well conducted fermentation.

The porter now brewed can no more bear the sudden chill of a cooling atmosphere in the barrel cleansing, without too immediate a condensation

condensation and separation of its parts, than it is able to sustain the quick changes of a warm atmospcre, without an immediate tendency to acidity: as things now are, either extreme can only be avoided by a more attentive advertence to the mode of *cleansing*, so as to prevent a predominant tendency to either, by adopting the means proposed, or such other, on the same principle, as are equally likely to preserve the quality, increase the strength, promote transparency, and avoid acidity.

I know it may be urged by the most able brewers, that a high and rapid fermentation in the cleansing is a principal cause of that flavour for which porter is distinguished; that this kind of fermentation leads to a more perfect attenuation; and some of them may with great truth add, a perfect attenuation is the genuine mode of early bringing beer forward. This I most readily grant; it is the doctrine I wish to inculcate. The greater gravity of keeping beers, preserves them in a *mild state*, while their spirituosity prevents acidity.

The flavour of the colouring now in use, nor the change it induces, is not by any means adapted to preserve the genuine flavour of porter, or compensate for that made in the change of malt.

A change I by no means condemn with respect to the malt; but, however advantageous to the length, we must not altogether give up flavour, while we may equally as well, and indeed much better, preserve both by a due admixture of each sort of malt, and with suitable additions and proper correctives in the process or preparations of porter, both salubrious; as by the subsequent mixture of stale and mild beer before sending out; or afterwards, by drawing them from different butts into the same pot, when on draught, to suit the palate of each respective customer.

I hope it is by this time understood, that my views are to raise the

Process

Process of Brewing above the vulgar error, that tyrant custom has entailed on it, and that by the free exercise of the brewer's abilities, both in a scientific and tradesman-like manner, so as advantageously to preserve flavour and quality, with almost any proportions of every sort of malt, he might occasionally be obliged to use.

This is only to be accomplished by accommodating the quantity and *heat* the *liquor* is taken at in each mashing, to the grist; and the manner the worts are boiled, cooled, fermented, and cleansed, in; with a proper attention to the starting part of the business, cellarage, and change of temperature. In these operations the *cleansing* is a material one.

A beneficial manner of accomplishing each of these desirable objects may, in my apprehension, be gathered from an attentive perusal of these papers; and where the hurry of business may prevent this, or a wish to obtain a deeper intelligence, or more perfect knowledge and illustration of the principles on which this Doctrine and practice is founded, the *Author* will always be found ready to bestow his labour and attention, by practically inculcating his Doctrine at the *Brew-house, Distillery, &c.* of those who may condescend to be informed; where an hour's conversation on the spot occasionally repeated, with the operations before them, may be equally instructive to some as a day's reading to others, and cannot fail of being beneficial to many who may adopt these improvements; as by this means theory and practice go hand in hand, advantageously uniting to explain each other by practical demonstration; even hints in this way, must be of importance to ingenious men on so interesting a subject. Many intelligent brewers and distillers have been at the very verge of useful discoveries, and never arrived at them for want of such opportunities as I here propose,—a conversation with men of reflection acquainted with first principles, who have more methodically considered the subject, whose labours and studies they might profit by.

The

The world is continually exclaiming, that *experience* is better than *theory* ;—this is very true, for example, a man who has had a very long experience, may in general perform operations with tolerable exactness, but this he undeviatingly does by certain stated means, without any deeper intelligence of the process. I would, with Mr. *Chaptal*, compare such a man to a blind person, who is acquainted with the road, and can pass along it with ease, and perhaps even with the confidence and assurance of a man who sees perfectly well, but is at the same time incapable of avoiding accidental obstacles, incapable of shortening his way, or taking the most direct course, and incapable of laying down any rules which he can communicate to others. This is the state of the artist of mere experience, however long the duration of his practice may have been as the simple performer of operations.

Brewing, Fermenting, Distilling, &c. are branches of commercial chemistry, deserving of national indulgence, as sources of wealth, and resources of government. Chemistry is as much the basis of the arts and manufactures, as mathematics is the fundamental principle of mechanics.

The Distillers cannot cleanse or rack-off to advantage; their present mode of work does not admit of it, as much of the vinous spirit would be left in their bottoms, or gross parts, and much of the fine spirits absorbed by the atmosphere. With this observation in view, let us recall to their recollection all that has been said in these papers on the proposed application of the fixed and moving attemperator, in cooling the Worts or Wash, in attemperating them in the gyle-tun and fermenting-back, and in cleansing.

The Brewers Cleanse at the meridian height of temperature. Have not the Distillers a meridian height of temperature in each fermenting-back? Certainly they have.

Would not the descent of a moving attemperator at this, or at any period of an over heated fermentation on one hand, or a cold, sluggish one on the other, beneficially regulate the attenuation, prevent acidity, and promote the further decomposition of the unattenuated fermentable matter, and increase the vinosity, or spirit? Certainly it would. Should a fixed attemperator be more commodious in suitable cases, that is, in cases suited to the manner the utensils are disposed in, might not similar benefits be derived from its use? It is to be accomplished in this way; the air of the atmosphere, consumed by the burning fuel being caused to pass through the attemperator in its way to the fire under the brewer's or distiller's copper, still, or steam-engine; in the same manner heated air might be caused to return; and to either prove a heating or a cooling medium at pleasure.

This would be accommodating these important implements of science to practical advantage, both in the process of fermentation and distilling, which in the one are called *attemperators,* and in the other, Condensers, or *Refrigiratories.*

The *Malt Distiller,* from being so much better acquainted with the doctrine of fermentation than the brewer, cannot fail to see the advantage of cooling the worts or wash, without admitting the air of the atmosphere to come in contact with them, to oxygenate or acidify them; he is already acquainted with the advantage of a close fermenting vessel; he wanted nothing more than a hint to embrace and employ the method of saving and applying the fugitive gas; and of either filtering it of its vinous spirit, or fixing it by the proper intermedium, and an effective mode of supplying the deficiency of hydrogen in the incipient state of the fermentescence.

The soft, cooling, attemperating quality of atmospheric air, applied through the medium of the attemperator, is still more congenial to the Wash of the Distiller, than the Worts of the Brewer, whose

object

object is not to precipitate and separate the grosser parts of his fermenting fluid, but to suspend and combine them, and thereby render them buoyant during the process of distilling, as a deposition of the feculencies on the bottom of the still gives that burnt flavour to the spirits of the first extraction, called Empyreumatic, which it is as much his interest to avoid, as he values the reputation and sale of his goods: and which experience has taught him to avoid by studied attempts to approach to a perfect attenuation. For what is a perfect attenuation, but a full decomposition of the saccharine, the mucilage, and *gluten* of that heterogeneous mixture, distiller's wash, and the recombining them into one homogeneous fluid.

The Empyreuma, or burning, proceeding from the superior gravity of unattenuated over the attenuated particles of gross matter in the fermenting fluid, which he has not at present the advantage of getting rid of by cleansing, or racking-off, that the brewer has, is only to be overcome and rendered subservient to his purpose by such kind of attenuation, and the means hereafter proposed.

Demonstrable as follows: Barley is in an unattenuated state until malted. Malting is a species of attenuation. Grain when malted is lighter than grain unmalted; the better any sort of grain is malted, the more buoyant; this is distinguishable by throwing a few grains of malted and unmalted corn together into a glass of water; the former will swim, the latter sink.

The more justice that has been done to grain on the Malt-floor, the lighter it will comparatively be. The better it has been managed in the Malt-kiln, the more of its former gravity it will regain, without injury to its complexion or quality: for when *blown*, so as to increase its bulk, that three grains, for instance, will occupy the space of four, as Ware Malts used to do, though comparatively lighter, they are not comparatively good. Hence arises the advantage of adjusting the

quality of malts, by taking the specific gravity of the extracts or worts, by the hydrometer, as the best criterion of their value.

The deficiency of that species of attenuation that malting gives to grain on the malt-floor, can only be compensated by a more elaborate fermentation in the gyle-tun and fermenting-back, a circumstance hitherto totally overlooked.

When we maturely consider these observations, and reflect on the great specific gravity of their worts, or wash, which may be taken at a medium at thirty pounds specific gravity; we may easily conceive the necessity for a complete attenuation, the heat of which, at its meridian height, is sometimes too considerable not to want attempe-rating, to bridle its impetuous tendency to acidity, and curb its rapid intestine motion, which, in the way proposed, is a compassable thing, without inducing a separation of its parts, such as the brewers' worts undergo in cleansing.

When we further consider the quantity of unmalted corn they use, and how large a portion of that is sometimes wheat, one-fourth part of which last is a very tenacious animal gluten; this compared with the specific gravity of their wash, we must see the necessity there is for a very full attenuation, to prevent part of the gross contents being precipitated, and burnt on the bottom of the still; the gravity and grossness of which prevents the wash ever appearing, by the hydrometer, to be completely fermented, but usually retains some pounds of apparent or real specific gravity, more than can be attributed to lees and yeast. The heat necessarily acquired in distilling so dense a wash, will otherwise, always *char* a part of the undecomposed gluten and mucilage. In the Appendix it is remarked, that gluten promotes the attenuation of the other component parts of the fermentable matter; how highly advantageous then must the addition of wheat be?

If

If the wash obtained from malted corn is not well attenuated by subsequent fermentation, it is consequently disposed to deposit part of its feculencies on the bottom of the still from any mismanagement or neglect of the fire, or a relaxation of the heat at any time necessary to keep up the distilling process; how much more disposed must the wash drawn from a mixture of malted and unmalted corn be to such a deposition, when it has not undergone a most complete attenuation by subsequent fermentation before it is committed to the still, I leave to the judgment of the intelligent distiller.

There is but one way that at present occurs to me, of getting over these obstacles to a perfect attenuation, and preventing a subsequent deposition of part of the feculencies of this heterogeneous mass on the bottom of the distilling vessel, when the perfect attenuation recommended has not been obtained, which is to rack-off, cool, and cleanse; and to submit the grosser dregs of this cleansing to the lever press to separate the more fluid, from the more solid parts, and commit the former to distillation, and dispose of the latter to the hatters, or mix it with the spent wash for feeding hogs or horned cattle, which would hearten them more, and bring them forward better, than the usual addition of bean-meal now used, without any important draw-back upon the produce of the spirit, and ultimately without any increase of expence.

This racking-off, cooling, and cleansing may be performed with the assistance of my mode of work without the admission of the air of the atmosphere, or the exposure of the fermenting fluid to the action of the super-incumbent air, to either oxygenate it, or absorb a particle of the vinous spirit by the solvent and receptive power of the atmosphere.

Should this mode of work come to be adopted by the brewer, he will so concenter all the advantages of fermentation in is process, as

to

to make his beer and ale stronger, more spirituous, better flavoured; more pungent, transparent, and fine, with an ease and convenience within the comprehension of every one, and with uniform certainty and success. This will be much promoted by delaying the cleansing much longer than is at present practised, from which no bad consequence can ensue when the process is adjusted by the attemperator, as it cannot then overheat and receive a disposition to acidity, &c. It cannot flatten in close vessels, as it otherwise might from exposure to the air, and be acidified by the oxygen of the atmosphere, nor can it loose a particle of spirit for the same reason.

It must be obvious from these remarks, that Worts and Wash may be more perfectly attenuated by regulating their temperature, and occasionally prolonging the process of fermentation, and that without hazard, loss, or inconvenience. Such well attenuated beer or ale will not stand in need of helps to bring them forward, promote transparency, &c.

With respect to the brewer, he can never obtain the full advantage that cleansing in quantity has over cleansing in barrels, while he continues to cleanse so soon: nor can those who cleanse in barrels attenuate so completely, or retain the genuine porter flavour in their beer, without falling back into the old proportions of high dried malt, or drawing a shorter length, this kind of cleansing making a thin instead of a full flavoured strong beer. Both these inconveniences may be avoided by using cleansing vats and attemperators.

With respect to the *Quantity* of *Liquor* at present used, can any thing be more absurd than the over proportion with which they sluice their second and third mashing, which, instead of answering any good purpose, serves only to dissipate or waste the volatile parts of the malt and hops, and expend fuel in evaporating it off, or boiling down the worts to their *standard gravity*? It is really a nice and advantageous

thing

thing to minutely attend to the due proportion of liquor used, and to put an end to the present wasteful and slovenly practice of sluicing the second and third mashing with so much superfluous liquor, independent of the injury so much unnecessary boiling does to the subsequent fermentation, and its consequent influence on the attenuation, which it manifestly clogs and defeats, thereby laying the foundation in a great degree of many of the inconveniences which the brewer meets with to briskness, pungency and transparency, and gives a tendency to foulness, flatting, and acidity. For every strata of vapour or steam that the atmosphere takes up or off from the boiling worts, it communicates a part of its oxygen to the hot fluid, caloric or heat being the *intermedium* that unites this acidifying principle to the worts. These animadversions are an additional reason in favour of *Close Mash-tuns*. See this article in the description of the utensils, &c.

These are not the only advantages derivable from *short liquors*; they bring the worts off much finer; which makes them less firey or tumultuous in *fermentation*; more temperate and clear in *cleansing*, and sooner bright and drinkable after *starting*.

The solvent power of the *liquor*, instead of being diminished, may be increased by a due attention to the proper *heats*, when no more is used than what barely covers the grist during the operation of soaking, or steeping in the tun after mashing, called *standing of the tap*; the supernatant fluid, or liquor that stands above the grain in the mash-tun, so far from acting during this part of the operation, counteracts the expected effect by its pressing on the immerged grist, which would otherwise stand looser when charged with no other weight or pressure than as much liquor as barely covered it.

It is, or ought to be well known, that the solvent power of the liquor depends on the *heat* it is taken at, and the nature of the malt, grain, or grist, to which it is applied, different malts, &c. requiring a different

different heat to dissolve the whole of the *farina* or flour of the malt or grain employed. When this is meant to be done at two mashings, and a third liquor mashed through the grains for the first or second mashing of the next goods, the utmost care should be taken in adjusting the heat of the liquors. When the mashing is to be performed with short liquors, three full mashings are certainly necessary, with the same scrupulously exact method of taking the heat. In either way the tendency of this exactness is intended to avoid dissolving too great a portion of the saccharine matter, or mucilage of the grain, at any one mashing, (for saccharine matter is mucilage) particularly at the first, as the disposition of the remaining *farina* of the grain to dissolve will be proportionally less, and much of the earthy or grosser parts of it, with a portion of the finer, will be inevitably locked up in the grains, and sometimes visible to the eye, if a handful of them is examined after the operation as they come out of the tun. See *Mash-tun.*

It is only by regulating and preserving the heat at a *suitable standard,* accommodated to the respective grist, that can yield a uniform extract each mashing, in which a due proportion of all its parts are incorporated. As in chemical and medical extracts, the gummous part enables the water applied as the solvent, to take up a greater portion of the resinous part of the plant; so the resinous part enables the proof spirit, when used as the solvent, to take up a greater portion of the gummous part of the plant; when water, the proper solvent of the gummous part, could not act on the whole of the soluble parts to advantage, from their being defended from its action by the resinous; nor could spirit act on the whole of the soluble parts of the plant, the gummous being insoluble by it: and though it is the proper solvent of the resinous, it could not dissolve the whole of it while defended by the gummous part of the plant; hence water only could not dissolve all the gum, nor spirit only, (that is alcohol) all the resin, under these circumstances, while proof spirits, consisting of nearly equal parts of each, becomes a solvent that acts on both. The same

may

may be said of the application of hot and cold water, or liquor, or mixtures of them, containing a heat proportioned to the quality of the grist or mixed grain employed, and the extract to be obtained. The more methodical way of managing, which is to regulate the required heat by the thermometer, the only just measure for *standard heats*.

Standard Heats are only to be acquired by the joint application of the thermometer and hydrometer together, the one shewing the *heat*, and the other ascertaining the *strength*, or *gravity*, of the extract obtained at that heat. Here, and here only, we lay hold of the clue that leads with certainty to the establishing of *Standard Heats*. A knowledge the most advantageous, and to be derived only from the use of these instruments in the methodical manner here proposed.

Boiling and *Evaporation*, we have formerly seen, considerably influence the future beer or ale. The benefit of short liquors saves a great deal of one, and totally precludes any occasion for the other. By which, injury is avoided in the abuse of the former, and benefit derived from the exclusion of the latter. In this case there is nothing more necessary than to *strike the worts* on the appearance of the proper *criterion*, or as soon after as the judgment of the operator directs. A further description of these operations may be seen under their respective heads; see also *Utensils*.

Fermenting in *Close Tuns*, where the compression evidently alters the face of the attenuating gyle, some of the appearances which govern the judgment of the operator may be wanting, were not a knowledge of the rising temperature obtainable by occasionally drawing up and examining the thermometer, and the hydrometer also consulted; otherwise these novel appearances might mislead his opinion in his first essay; but with their assistance he cannot err, and a few trials will make him master of the business.

Except there is a deficiency of heat in the fermenting fluid, or that the atmosphere is very cold, the man-hole in the fermenting back, gyle-tun, &c. need not be closed before the carbonic acid gas begins to break forth, or is sensibly observed; it otherwise may be left open without material injury until then. When kept closed from the beginning, be cautious in bringing a candle near the man-hole door or place opened to examine it, before the fixed air has began to break forth, or the hydrogen gas that proceeds from it may take fire, as it rushes out and blends with the common air; should an accident of this sort happen, it is immediately extinguished by closing the place it issues from.

Cleansing in apparently close vessels, may be thought to retain a portion of the yeast, and lees; that is, the buoyant part of the dregs that is thrown up and carried off while cleansing, that ought to be got rid of during this purgating, and depuration of the beer. This is not the case: the object of performing the process in this way, is to obviate the changes induced by the fluid being in contact with the air of the atmosphere, as already remarked.

As the distinguishing *flavour* and *transparency* of beer, are the result of a proper attenuation, as much as strength or spirituosity; and cleansing is certainly a material part of that attenuation, when properly managed, the remainder of the redundant gravity may be worked down here, and both the thermometer and hydrometer used to regulate the second attenuation in the cleansing vat.

Pellucidity and *briskness*, so far from being endangered by compression, (properly managed) are promoted; but as a vent for the superfluous gas must be given some where, let us attend to the cleansing apparatus, to be seen under the head *Utensils.*

By the method of *forcing beer,* there recommended, with the gas of

of the fermenting fluid, it is improved in spirituosity and brightness. In the same manner should all the beer drawn off into butts, be forced or racked off, it would keep it always saturated with gas, improve its strength and flavour, and prevent flatness and insipidity, particularly on mixing or making up beers. It would, therefore, be a good practice, to previously fill the empty store vats and butts with this gas, before the beer was racked into them, after having previously searched and cleansed them out with steam, as elsewhere directed; by this means no foulness, taint, or scent of any kind, could injure the beer or ale, as heretofore, and flatness could never occur, provided the vessels were air-tight.

An inspection of the gyle-tun and barm-safe may further help to explain this mode of work, a description of which is to be found under Utensils, with proper references to the plate; which is there considered as a cleansing-vat and barm-safe also. It may be also taken to explain the impregnators; the delineation of which may be found in the same plate. For a further knowledge of the pneumatic apparatus, and the improved utensils, I beg leave to refer to a Description of the Utensils and their respective Improvements, &c.

The *Distillers* know full as well as I can tell them, that the present mode of taking the excise on the wash, and by limiting the qantity, or number of gallons, of *wash* that shall make a gallon of spirits, at one to ten over proof, they are obliged to make it of the great specific gravity mentioned, to avoid paying an over proportion of excise for the quantity obtained; the grossness of which renders it impossible for them to make so clean a spirit as is procurable from a thinner or lighter wash, which super-saturates their spirit with a gross unattenuated oil, and also subjects the wash to catch and burn at the bottom of the still; this lays the foundation of that empyreumatic flavour, so difficult to get rid of by subsequent *Rectification.*

In Holland the duty is taken on the spirit, as sold at the Canteen, both for home consumption and exportation ; and, were the duty levied here on the quantity of materials used, estimated by weight, allowing for the difference of gravity between malted and unmalted corn, the distiller might make his wash as thin or light as the Hollanders, and have a much cleaner spirit than theirs, which is at present so much cleaner than ours, as to render their gin inimitable with our best rectified spirit, on account of the salts used in rectification causing the spirit to strike a bitter with the juniper berries, essential oil, &c. and the gross oil of the raw spirit is nearly as bad.

The fact is, that a genuine Brandy, Rum, and Hollands Gin, flavour, must be sought for in the fermentation and attenuation of the wash, and is not to be fully obtained by flavouring ingredients with rectified spirit, which, instead of a genuine, produces a compound flavour, always changing from bad to worse, although the spirit manifestly improves by age.

The *Lob, Bub, Groutting*, &c. of the English, Scotch and Irish Distillers, or other means employed for either protracting or promoting fermentation, I shall not for the present particularly advert to. Nor but very little to the *Attenuants* occasionally employed for *cutting* down *the head* of the *fermenting wash*; nor make many remarks on the sensible noise, intestine motion, irritation, and tumult they excite in the mass of fermenting fluid, which are very perceptible to the ear and eye of the operator. Neither shall I draw a comparison between the great simplicity of making *Brandies* in France, *Rums* in the West-Indies, *Gin* in Holland, and the mode of work in England, further than what I have just now said on the influence the different manner of taking the duties in the different countries have in operating on the *quality* of the article produced, in nothing more conspicuous than the unsuccessful attempts to make *Hollands Gin* in England, indistinguishable from that imported, though in full possession of the

requisite

requisite materials. A kind of *legal disability* that cramps genius, clogs the wheels of commerce, and lessens the resources of government, so far as it interferes with this great branch of annual supply, the excise. See Brandy, Rum, and Hollands Gin, under *Rectification.*

Without entering here minutely into the doctrine of ferments and attenuants, I shall briefly observe, that the use of those occasionally employed for cutting down the frothy head of a *distiller's fermenting back,* effects this by the inciding intumessence they excite, by increasing intestine motion in all directions, without raising froth or bubbles; as it breaks down cohesions and resolves viscidities; yet so much of this noisy tumultuous gas does not escape, as when it more silently expands the tenacious fluid into bubbles, that are continually breaking and letting off the gas, which, instead of here flying off by repulsion, are as quickly united by mutual attraction as disengaged, facilitated by the intestine motion, that enables them to present a continual change of surface for the polar arrangement of their affinities; that as they instantaneously resolve into gas, they may as rapidly combine into new substances, and form wine, beer, or spirit.

Gasses, and especially vapours, continually tend to combination, because their nascent cohesion is weak; and nature, which is constantly renewing the productions of the universe to supply those which are as constantly decomposing, never combines solid with solid; but, reducing every thing into the form of gas, by this means removes the obstacle to their union, and these gasses uniting together recompose matter in their turn, which assumes its original fluidity and solidity, agreeable to the uniform circle in which nature continually moves; and in the business before us, is the cause by which we effect the fullest attenuation, and the most considerable production of vinosity, to produce wine, beer, or spirit.

When this, and the previous part of the business, is properly

managed,

managed, the gross oil of the grain, or other fermentable matter, is more perfectly attenuated, and their essential oil more highly exalted, or volatilised, and the fluid mass more perfectly depurated, so that the produce is increased in quality and quantity, and may be truly called a *cleansing* in the gyle-tun, or fermenting-back, in which, as the noise and motion cease, and the heat gradually declines, the feculences are deposited, and in their precipitation leave the supernatant fluid vinous and transparent; it is this declension of heat that fixes the union of the *incipient spirit* in the fermenting fluid, that the presence of caloric kept in a disposition to be volatilized and lost.

It is generally thought, that the sooner the vinous fluid is committed to the still after a cessation of the fermentation, the more of the spirit is preserved, which is certainly right where close vessels are not used, and where they are, when any delay would be making an acid instead of a vinous liquor, or when the previous part of the fermentation does not satisfactorily succeed to the operator's expectation; under these circumstances, it may not always be in his power to beneficially prolong the fermentation with an intention to accomplish a more complete attenuation, without being in possession of the necessary means of immediately supplying the deficiencies in carbon, hydrogen, or oxygen, that may have occasioned a defect in the process at present so little understood.

By the proper application of such means, and the use of the *attemperator*, much may be done, to a conviction of which a few trials will immediately lead. A thermometer applied at the entrance of the cooling medium, and another at the place where the imbibed heat passes off with it, shews the acquired or present temperature, and celerity with which it is performed. See Cooling Attemperator.

It should be carefully noted, that the animal gluten of grain has a tendency to the putrefactive fermentation; the viscid mucilage of raw

corn

corn to acidity; and the saccharine mucilage to vinosity; and that all mucilages, decomposed by the low combustion of fermentation, generate much fixed air, which only can be saturated and neutralized into vinosity by saccharum and hydrogen, and attenuated by oxygen.

The Acid Process usually succeeds the vinous process of fermentation, and is always subsequent to it with vinegar-makers, although this does not necessarily follow. The acetous may be made to precede the vinous process. Saccharine and fermentable matter may be acidified, without passing the intermediate state of the vinous process. We have daily examples of this in economical, culinary, and commercial operations, that is, in making flummery, or sowins for the use of the table; starch for commercial purposes, and leven for bread. The production of fermented bread is a *vinous acetico process,* in which the heat of the oven extinguishes the acid tendency. The not properly attending to these things, which are hourly soliciting our observation, and gaping after those which glitter at a distance, is no compliment to our penetration, I had almost said to our understanding.

How staggered, even at this enlightened era, whould some of our experienced brewers and distillers be, were they asked this one very simple and plain question, In what does fermentation consist? Had they but previously asked themselves this very natural question, how easy it must have been for them to have resolved it, who have had so much experience of its effects, whose business it has been for years. Yet I will venture to say, that it would be as difficult with some few of them, as the 47th problem of Euclid was to our wise-acres of mathematicians, until resolved by Lord Napier. * When Columbus had discovered the American Continent, and was afterwards soliciting the assistance of the Court of Portugal, in confidence that some merit attached to the discovery, he was told by the cabinet ministers that any

* It was Pythagoras that resolved it.

any body could go there: on which he called for an egg, and made some essays to set it up on end on the table before them; then handed it to them, to try what they could do; finding none of them succeed, he gave it a little bump at one end, and it stood up with ease. They one and all cried out, any one could do that; Yes, replied Columbus, when you saw it done; and now any of your seamen can navigate a ship to America, after I have shewn them the way. This simple comparison extorted their approbation, and obtained for him his request.

In the process of brewing Porter, Ale, Twopenny, &c., to be subsequently treated on, the practical minutia of Fermentation and attenuation, shall be circumstantially laid down in each, so as to account for, and distinguish the variety of flavour, &c. assignable to each *cause, effected* by the different modes of treatment.

DESCRIPTION

DESCRIPTION OF THE UTENSILS, &c.

Mash-Tun. Among the apparatus described and delineated here, the *Mash Tun* takes the lead. To the short description of the one here proposed, I shall add, that steam only keeps these vessels; it either circuminvolves or passes through at a boiling heat, while the steam issues at the extreme or opposite end, or side, to that it enters at; and that provision should be made for such part of it as condenses running commodiously off; this, when convenient, will be best at the apperture where the superfluous steam escapes.

The observation made on the over proportion of liquor at present used for the second and third mashing, should be adverted to, as a corroborative of the reasons in favour of a *close mash tun*; for which, see further, under the article *Mash-Tun*.

Every one acquainted with brewing, cannot possibly require a description of the ordinary, or *old brewing copper*, over which is usually placed a back, made of wood, commonly called the *copper back*, which, at the same time, that it serves for a cover to the copper, is occasionally filled with *liquor* or *worts*, ready to be let down, as soon as the contents of the copper is all drawn off. By the use of this copper, the volatile parts of the malt and hops evaporate during the boiling of the worts, to the impoverishment of the future gyle, and the waste of these materials. Therefore I need not give a design or drawing of it.

Cylindric Brewing Copper. In the plate delineating this important utensil, *B C* is the brewing copper, enclosed in brick-work, placed over two fire-places *f f*. *U C* or *C B* the upper copper, or copper back, for heating the liquor while the worts are boiling. *C* a condenser for receiving and condensing the volatile parts of the malt and hops of the first and second mash; which are here received and condensed in some cool worts reserved for the purpose, and when condensed, conveyed into the body of the worts in the copper; that is, in boiling the remainder of the second, and the whole of the third worts, as may be seen by inspection, and consequently there preserved; *s v* a safety valve, to let the incondensible air off. *p p* the valve-pipe, connecting the condenser and copper together; *p v* the valve, raised by the steam in its passage from the copper to the condenser; *b c r* the bottom-pipe, by which the worts return into the copper, by turning the cock *c*.

In the Dome Coppers, with a copper liquor back at the top, this is not the case; there the tubes or pipes for saving the volatile parts of malt and hops, by condensing the steam of the boiling worts of the first, or first and second mash, in the liquor heating for the second or third mash, is lost by being subsequently exposed to the evaporation of the second or third worts, in boiling them down to gravity, the waste of which is but too apparent to the whole neighbourhood, who are annoyed by the strong smell of the volatile part of the worts and hops, which even the solvent power of the atmosphere cannot take up, until wafted to a considerable distance. There is an additional inconvenience, part of the volatile bitter obtained in heating the liquor, is deposited in the grains when this liquor is turned over the goods, which hinders cattle eating those grains, on account of their bitterness.

But this is not all: this kind of condensation has a mechanical disadvantage, and causes an additional or superfluous consumption of coals

coals to resist the whole pressure of the atmosphere on the broad surface of the liquor or copper back, into which the before mentioned tubes or pipes discharge their steam, under the plausible pretence of heating the liquor by steam, saving of fuel, and the volatile principle of the malt and hops at the same time. Instead of effecting either of which, it appears, on investigation, that an additional quantity of fuel, and a consequent increase of expence is incurred, without accomplishing the desirable purposes in view. On the contrary, both of these desirable purposes, and above one-half of the coals used under the dome coppers is saved by the addition of my condenser to the cylindric copper proposed, its figure and the manner of applying the heat, may be seen under a fuller description of Brewing.

If we strenuously prosecuted the idea recommended, of brewing with *short liquors*, the whole business of evaporating or boiling down to increase the weight of the second or third worts, so as to bring the whole gylc to the requisite standard gravity, will be nearly saved, and all the boiling may be performed in a close copper, that may be necessary to impregnate the extract with a saturate infusion of the hops, and sufficiently boil the worts to the usual criterion. See the article *Brewing Copper*.

Coolers. To what is said under this head, we must add the whole of what is demonstrated under *Cooling Attemperator*. By which it appears, the common coolers may be in a great degree, if not entirely, dispensed with.

But if their use is continued, they may be advantageously floored with lead, so as to form a double bottom, for the circulation of the air in its passage to the fire-places of the copper, still, engine, &c. to imbibe and carry off the heat of the worts. See *Cooling Attemperator*.

Cylindric Stills. In this plate, the cylindric still is delineated at work. *A B* the cylindric still, enclosed in brick-work, placed over two fire-places *f f*. *D* the upper still, worked by the flame of the two fires in its circumvolution round the lower or cylindric still, in the manner described under this important utensil.

The *under* is presumed to be the *wash still*; the *upper*, the *spirit still*. *A* the arm of the wash still, communicating with the condenser or refrigiratory in the large worm-tub *w*, on the right; *c* the arm of the spirit still, communicating with the refrigiratory in the lower worm-tub *w*, on the left side, each supported by its proper stand. For further particulars, see the full description of stills and brewing coppers, which are explanatory of each other, whose figure, and the disposition of their flues, point out the certainty and great saving of fuel, which are the least of the advantages connected with these two important utensils. See the article *Stills*. There is a mechanical disadvantage in applying cold water to the head or breast of a still; it causes the vapour to circulate and condense within the body of the still, into which great part of it unavoidably falls back again; and the cooling medium being placed over the heating medium, causes the denser particles of the wash to precipitate and burn on the bottom of the still, and obliges a greater fire to be employed to counteract the influence of the cold impressed on the surface of the hot fluid. See a fuller description of the *Cylindric Still, &c.*

Refrigiratory or Condenser. This plate exhibits two views of this capacious condenser, invented on a rational principle, calculated to remedy the defects, and supply the place of the common worm. *A B* the refrigiratory in the worm of liquor tubs. *A B, B O O* a section of the liquor or water valve represented in the condenser *A* over which, at *c c*, the steam or vapour ascends according to its superior levity compared to atmospheric air, in which it ascends: a full description of this may be seen under the head *Refrigiratory*, &c. *a p v v* air-pipe

pipe and air-vlve. *T S* air-tube for passing of the contained air, and the air generated during the distillation; *l v* the lower valve at the beak of the worm or condenser for letting out the condensed vapour, and preventing the entrance of the air of the atmosphere.

B a view of the refrigiratory with its arm or mouth-piece, *A* into which the arm of the still conducts the vapour, and is in all respects similar to the other. *See the article Refrigiratory.*

The Pneumatic Gas Furnace is intended for forming and employing carbonic, oxygen, and hydrogen gas, and carbonated hydrogen air; a more particular description of which will be given hereafter. It may be seen in the plate, denominated *Variety of Pneumatic Operations*; and in the plate containing the *Distiller's Back Room.*

Wash Still. *W S* in this plate presents a view of a wash still, independent of *S S*, which represents it as surmounted by a *Spirit Still.* This is the *New Cylindric Still* and the new refrigiratory at work. *W T* the worm-tub, *a p* the air-pipe, *A* the arm of the still, entering the mouth-piece *M P*; *l p* the lower pipe, or pipe of delivery, formerly called the beak of the worm, *f f* the fire-places. *S* the stand of each worm-tub.

S S W T is the spirit still, with its proper refrigiratory and worm-tub, stand, &c. The two together may serve to delineate a *Rectifier's Still.* The under must then be supposed to represent the still containing the *raw spirit,* and the upper, the *compound still*; so that while the under is rectifying the *raw spirit,* or making *Gin*; the upper one is making compounds, or spirits of wine. See the *Rectifier's Still.* *N. B.* this still has double ends to keep in the heat.

The Distiller's Back Room. This plate contains sixteen fermenting backs, in two rows, *A B*, &c. and *I K*, &c. *P E A P* the pneumatic

pneumatic engine air pump, for transferring the gasses, and impregnating, &c. *P G F* the pneumatic gas furnace at work. *M* the moving attemperators, for shifting from back to back. *N. B.* the main-hole in the fermenting backs, gyle-tuns, squares, &c. should be left open until the gas begins to break out, except there is a deficiency of heat in the fermenting fluid, or that the atmosphere is very cold; in either case it may be then shut from the beginning, *C C C* three coolers. *S P, S P,* spiral pumps. *Pn E.* pneumatic engine. *M P,* a main-pipe conveying the wash to the backs. *c c c c c c c c* eight cocks to let the wash out of the main-pipe into the backs. *M A,* a moving attemperator, suspended to a beam. *B M,* the beam for transferring the moving attemperator with its tackle from back to back. *M A,* a moving attemperator in the back *A.* *P C,* a pipe connecting the main-pipe and coolers *C C,* together.

The Double and Triple Refrigiratories, or *Zigzag Condensers.* These are to be found in the plate with the gyle-tun and barm-safe. No. I. in a proper worm-tub, may be applied to receiving and condensing the vapour and spirit of two stills; or to the cooling of the worts in their passage from the copper to the gyle-tun, or from the under-back to the fermenting-back. *W T,* the worm-tub, *u p v,* three air-pipes and valves; *m p—m p,* two mouth-pieces, for the reception of two arms or stills.

No. II. a second view of the triple refrigiratory *a p v,—f f f,* the three air-pipes for carrying off the elastic incondensible air, after it has been filtered and separated from the condensing vapour; *f f f,* three funnels, that is, one to each division of the refrigiratory, for filling up the valve of separation, or liquor valve, before each distillation; *m p,* a mouth-piece; *d d d,* three delivering pipes, one to each division of the refrigiratory. See *Refrigiratory.* For No. III. see *Gyle-tun,* with a *Barm-safe.*

MASH TUNS.

Mash Tuns, it must be allowed, have derived much improvement from the application of *mashing machines,* as well in more effectually executing that office, as in saving both time and labour on the great scale of work; but still greater advantages would be derived from adopting my *mush-tuns,* some of which may instantaneously strike most practical men at sight, and the remainder must follow from reason and reflection, until experience confirmed the fact; none of which may exceed the advantage of being able to preserve an *equal heat* from the beginning to the end of each *mashing* and its subsequent *steeping*; or during both, to be able to raise the *heat* to any required pitch.

By these means, an extract, or wort, of any requisite quality and strength, can be made much sooner than in the usual way, saturated with the whole essence of the malt; in the obtaining of which, the heat may be so varied as to separate and incorporate that due proportion of all its parts in the manner that the intended worts, beer, or ale, may require, uniformly blended by one, or at most, two mashings, which will be found sufficiently to dissolve and extract the whole of the farina of the malt; and thereby much subsequent boiling and evaporation of the weak worts saved, and the heat regulated and preserved at any standard, during the whole of the process of mashing and steeping, as hereafter explained in the *specification* of my Patent.

And may be effected by making the *mash-tuns* air-tight and double;

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by double is meant an external casing; also air, or steam tight, from six to twenty-four inches asunder, in proportion to their capacity; and by filling up, and keeping filled, the space between the casing and mash-tun with *steam*, during the mashing and steeping.

This may be easily accomplished by those provided with a *steam engine*, by having a pipe from the engine to communicate with the casing of the mash-tun, and proper cocks to turn the *steam* on and off as occasionally wanted.—Those unprovided with a steam engine, may be equally well served with steam from a proper boiler proportioned to the quantity wanted, and the time its application may be continued, provided with proper cocks, &c. which will at the same time serve for sweetening the brewing and fermenting utensils, &c. being the most effectual way of sweetening and cleansing them, and preventing *furring*, *foxing*, &c.

BREWING COPPER, &c.

In order to conceive the annexed design of the Brewing Copper, a model has also been made to explain to the workmen how it is to be erected and worked; the whole of which can be taken asunder and put together in a few minutes, for the more particular inspection of all its parts.

From the want of a more particular knowledge of the nature of fire,

fire, and the application of heat, much time and fuel has hitherto been unprofitably wasted.

Had the generality of men, engaged in brewing, distilling, and other great branches of commercial chemistry, more attentively viewed the common and most obvious phenomena of combustion, the application of burning fuel to the body to be heated, would have long before now been better understood.

But the principal object of their attention having been to extend the capacity of the apparatus or utensils employed, in proportion to the work to be done, except in a very few instances, care has been taken only to enlarge the fire-place in a random proportion to the size of the copper, still, &c. employed; hence the enormous increase of the quantity of fuel to half a chaldron, and from that to a chaldron or more of coals used at once to light and continue the fire under the largest brewing coppers, stills, &c. to the manifest waste of fuel, and the destruction of the vessels, fire-work, and erections that contained them; losses of great importance, causing a large drawback on the profits, which has never been sufficiently attended to, while the expected effect was produced, for want of duly considering how much better the object in view might be obtained at less expence.

Being much occupied for the greatest part of my life in chemical pursuits on a very extensive scale, I early saw, and studied to avoid, the destructive force of this useful agent, *fire*, and at the same time to render it subservient, in its fullest extent, to these important purposes; which I have at length accomplished, by much observation, improved by experience.

Finding the present form of brewing coppers, stills, &c. which custom and their apparent simplicity has so long established, incapable of that equal distribution of heat requisite to apply the whole

effect of the burning fuel in the most advantageous manner, both with respect to the vessels and their contents to be heated, and to prevent them, and their surrounding brick and iron work being destroyed, I was induced to deviate from the common form so long established.

The form that most commodiously suited every purpose I had in view, both with respect of saving time and fuel, and preventing the destruction of the utensils and their erections, was simple cylinders. Here it may be necessary to observe, that the coppers and stills now in use, are each (nearly) the section of a cylinder, set on its base or bottom over the fire, and that either the circular or warm flew convey the flame and smoke round the side into the chimney; instead of which I set a long cylinder nearly parallel to its axis, or, in other words, on its side, over the fire, and carry the flame and smoke round and round in a spiral direction towards the chimney; which may be seen by inspecting the model, to stand about mid-way between the two fire-places.

By making these cylinders two, three, or a greater number of diameters long, or in other words, twice or thrice as long as broad, I bring the heat nearer the center of the contained fluid, which, by the number of circumvolutions or rounds the flame takes before the smoke arrives at the chimney, the flame and heat is exhausted on the matter to be heated; and by incessantly passing under and over every circular inch of the cylinder, the heat is applied, and penetrates in all directions from the circumference to the center along the axis of the cylinder, and not by successively heating, strata super strata, or one part after another, as now practised; but, by immediately circum-involving and acting on the whole mass together, saves the time and fuel, by the application of almost every particle of heat.

The cylindric figure of these coppers, stills, &c. admitting of the easy

easy application of two, three, or more fires, by which the ignated fuel, and a more equal distribution of it, and the flame and heat, to the vessel and fluid to be heated, is completely effected, and comparatively with very little fuel.

This figure commodiously admits of a copper or boiler equally capacious being placed over it, and by forming the upper or top covering-in of the flues, imbibes, first, (at its bottom) the heat in the circumvolutions of the flame and smoke round the cylindric copper; and, secondly, as appears by the model, the remaining heat in its passage from each fire (instead of passing into the chimney when it has performed its circuit) ascends and takes a turn round the sides of the top copper, which, by means of proper registers, may be made to boil as soon as the great cylindric copper, managed so that one or other of them shall be made to boil alternately or together, as occasion requires, with the same expence of fuel and the like dispatch.

The upper vessel may be an open or a covered copper: the under or cylindric copper may be commodiously divided with one or two partitions into two or three coppers: when divided into three, the middle one is heated by the flame only, of the fire placed near each end of the cylinder, (as seen in the model) yet it will boil as soon as either of the divisions under which the fire is placed: the three or more divisions proposed, will not be like having three or more smaller coppers of the size of one, but enjoy the separate and joint advantages of one, as occasionally wanted, at infinitely less expence both in fuel, coppers, &c.; which the intelligent brewer, distiller, &c. will easily comprehend and avail himself of.

The saving of fuel alone is no doubt an object, where ten or fifteen hundred chaldron of coals is annually consumed.

The great fires and immense heat now used, no utensils nor materials

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can stand; the saving, the wear and tare in these, is no inconsiderable thing, which will be the necessary result of dividing this great mass of *fuel* into two or more *smaller fires,* and more equally distributing the heat; these things considered, a judgment may be formed of the saving in both; when, instead of dividing, one half or two thirds of the coals now used may be subtracted, and this part of the work done in much less time; and the volatile principle of the malt and hops saved in boiling the strong worts, with an incredibly quick evaporation of the water of the weak worts, in boiling them down to gravity or strength.

The steam raised by the surrounding heat forcibly acting on all sides, and rarified by the same cause, instead of hanging in a cloud over the boiling fluid, is thrown off with astonishing rapidity, and with a velocity that renders it admirably adapted to cleansing and sweetening the butts or casks used to send out the beer or ale in, by a simple contrivance, hereafter explained, by which it can be employed to effectually extirpate *foxing,* &c. even in the remotest part of the premises.

The sum of these improvements, in themselves very considerable, are, when added to an improved mode of cooling, and advantageously fermenting the worts, so as to improve their flavor, quality, and strength, and prevent their *flattening, souring* and *foxing,* or being injured, as heretofore, by the changes of the atmosphere, will, I flatter myself, render the business of *brewing* and *fermenting* much more complete than heretofore, with those who adopt them, or are disposed to secure the privilege of using them to themselves only; and when the sum of the savings on each brewing are calculated by the number of brewings in each season, the aggregate of the annual saving will be considerable indeed.

COOLERS,

COOLERS, &c.

If cooling the Worts is really so important a part of brewing, and of so much consequence as it is generally understood to be, every substantial improvement should be adopted, until that perfection is obtained that ensures success.

Those I have to offer are more likely to carry conviction of their utility, from being regulated by certain laws of nature, well understood, sanctioned by the evidence of our senses, and if we are not under the influence of prejudice, I may boldly say, coolers, long as we continue their use, should in future have double bottoms, as the most certain and least expensive mode of cooling wash and worts by their assistance, as a quarter of the present number may be made to answer in half the time, if accompanied with the improvements I have to propose; then there will be money, time, and room saved, and dispatch, certainty, and success gained. Metal being an infinitely better conducter than wood, the bottom, on which the worts lay, should be lead.

By coolers in future having double bottoms, &c. the hot worts, wash, &c. may be laid with safety twice, thrice, or quadruple thickness, or depth they now are: one third or one fourth of that thickness or depth should the bottoms be placed asunder; but in general one, or at most two inches may be sufficient. The nearer these coolers are placed under, or over each other, the more will the business of cooling be

be facilitated, provided they are filled up as high as they conveniently can.

Although the very reverse of this is the present practice, and as great a riddle as it may seem to bear in its front, it will carry conviction in its rear. In the colder months of this climate, the attraction of the common atmospheric air by the heat of the worts, malt, wash, &c. drawn between the double bottoms of the coolers, and partly by imbibing the heat in its passage, and partly by throwing it off at the surface, it will to a certainty cool them with unexpected facility and dispatch, though laid at three or four times the thickness they are now laid at.

In the warmer months, and in changes from mild to warm weather in the colder, a stream or current of air should be forced between the bottoms, which can be commodiously done by a suitable apparatus I have contrived for the purpose, that can do it with an impetuosity proportioned to the effect intended. This current of heated air we shall soon find use for.

In the warmer latitudes, and in the hot months of these climates, particularly during the canicular heats of summer, a stream, or thin sheet of cold air or water may be applied in the same manner. It requires no extraordinary degree of penetration, to see, that the same means may be useful on any occasion of unusual dispatch, and that if my improvements of the working tun, and cleansing vat are equally as efficacious, porter can be brewed with more certainty and dispatch in summer, than is now done in winter. The air and water of the coolers is to be passed sufficiently slow to imbibe the heat of the worts, &c. For the warm air or water, we shall also find use in the progress of the proposed improvements.

Spiral-pump. To facilitate the cooling of the worts, &c. as wood

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is but a bad conductor, and but slowly transmits the heat to the surrounding atmosphere, it will greatly promote dispatch, to employ a metallic pump encircled with a metallic, flatted tube about eight inches broad, and an inch and a half wide in the clear, descending round the pump in a spiral direction, with two or more cocks at the bottoms to let the air or water run off in a stream, proportioned to the heat it imbibes from the ascending worts, wash, &c. The utility of this pump needs no demonstration, than that the hot fluid will be considerably cooled in its passage to the coolers ; nor is it hardly necessary to add, the same power or the same crank that raises the heated, may be employed to raise the cold fluid also, or the cold air or water, by slowly returning through the flatted spiral tube, will attract much of the heat from the hot worts, wash, &c.

By the further assistance of a deep cooler, or oblong vessel, in which a spiral flatted tube or worm similar to the distillers, placed on its side to prolong the passage of the wort, wash, &c. through it, the major part of the heat will be deposited, or these fluids nearly cooled before they reach the coolers ; by a combination of these means, the worts, wash, &c. formerly distributed in four, six, or a greater number of coolers, may be safely committed to one or two, of the same dimensions, from the preceding deposition of their heat, or, in other words, they may in future be laid ten times as thick in the coolers, (if their use is not wholly superseded) and this interesting part of the operation of brewing, conducted with a facility, dispatch, and security, that would set all future inconvenience at defiance, that has ever been before experienced, either from the change of temperature of the atmosphere, or any other cause whatever that I can at present foresee, that could affect this part of the business. All of which may be performed in less compass, with less time and expence, and in any climate.

My reason for recommending what coolers are in future used, to be placed near each other, is, that the nearer they are to one another, the

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more they will be acted on by the cold air, and the cold air or water introduced between their bottoms, the coldness of which at the bottom forms a cooling surface to that next below it, and so *ad infinitum*; and that the surrounding air of the atmosphere will rush with greater force to displace that rising from the worts, &c.; over and above this a current of cold air can more commodiously be impelled on their surface from their vicinity to each other, independent of contracting the space they take up; coolers at all times occupying much room in the brewhouse.

If we change this pump from a perpendicular to a horizontal position, it may still be applied to cooling, heating, and attemperating fluids in their passage, by cooling with *air*, and heating with *steam, &c.*

The same may be said of the application of the zigzag attemperator, the combination of the spiral pump with it may be so contrived as to supersede the use of coolers together, and cool the worts at once in their passage from the copper, or under back of the gyle-tun.

STILLS.

Great part of what has been said on the *Brewing Coppers* is applicable to the Stills; but least it should be objected to the latter, that the flame circumvolving them, may inflame or set fire to the vapour of the spirit, collecting in the space left to give room for the boiling of

of the fluid; it is necessary to observe, there is no room left in these stills for either boiling or expansion; to compensate for which, a sufficient space for these purposes is left in the Arm of the Still, into which, as the heated fluid expands, it flows over, is received and deposited, until a sufficient quantity of the fluid has distilled off, to give room for its return into the still. By this means the still is always full of fluid, or vapour and fluid, from the beginning to the end of the process.

Should not this completely obviate any such objection, it is to be hoped, the following observations will. The vapour or steam must either be heated red-hot, or come in immediate contact with a body so heated, to be accended or take fire, which cannot be the case here; first, the still being full in the beginning, cannot receive a red heat to inflame the distilling fluid, nor its steam; secondly, as soon as the steam rises, no part of the top of the still can be heated red-hot, as it could only acquire that degree of heat in the absence of either fluid or steam, their presence imbibing and continually carrying off the applied heat into the worm or condenser, where it is received and deposited by coming in contact with the cold continually supplied by the water of the worm-tub, which serves both to condense and refrigirate it.

It must be confessed, that during the vehemence of a strong boil, the impulse of the excess of fire throws up the boil, and with it the fluid from the bottom of every still, or copper, which are alternately bare, and covered, as the fluid rises and falls with the boil; during which the outer-part of the thick copper and still bottoms now in use, are nearly red-hot; yet, who has ever dreamt of the wash or spirit taking fire under these circumstances? Without air, even inflammable air, a much more combustible substance than spirits of wine, cannot take fire. In fact, there can be no combustion without air.

The very strong fire sometimes employed while the wash is running in, has been occasionally observed to heat the side of the still red-hot, before sufficiently full to rise above the flew of the fire-place; this might induce an apprehension, that the flame passing over as well as under my stills, might have the same effect during the process, and thereby endanger the still taking fire. The answer is obvious, if the fluid is not inflamed or set on fire in the first instance when the still is charging, with the advantage of the free admission of air, why should it be apprehended when the air is excluded, as it mostly is during the process of distilling; the very principle on which distilling is founded being to keep the heat stationary after it has arrived at the boiling point, and to exclude the air.

The apprehension of fire must be totally exploded, when we consider, that the fire even of inflamed spirits of wine is extinguished by excluding the air; and that the steam or vapour of distilling fluids, expel the air from the still and worm in proportion as the process advances to the distilling point, and that it is only when it is wholly expelled that the still comes to work, and the condensed vapour begins to run from the worm.

Should it be objected, that the flame has sometimes kindled so as to blow the still-head off, it may be answered, that this could not happen in my still, where not only the pressure, but the air of the atmosphere is excluded; flame can only be kindled in the head and upper part of the stills and worms in use, by the air entering at the under part of the worm; in mine, the air generated has free exit, but the valve prevents the admission of air from without, and all communication with the atmosphere whatever.

But were it even otherwise, the filling up the still quite full must remove all apprehension; for, although it might be said, that the quantity of fluid which the still takes to make it quite full, is continu-

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ally lessening from the beginning to the end of the process, (an objection more applicable to the stills now in use) it should be remembered, that the distilling fluid is at the same time growing weaker and less inflammable; that my worms, or condensers exclude the external air; and that the rising steam prevents the still over heating, by expanding over and occupying the space left by the decreasing fluid, and by continually carrying off the imbibed heat into the worm, or condenser, as before mentioned, by which all danger of fire is obviated; and an equilibrium preserved between the heat imbibed in the still and that deposited in the condenser.

By the united effects of the corresponding improvements in the still and worm, grounded on rational and very obvious principles, the result of observation, improved by experience, I raise a more copious vapour, and more quickly condense it; the raising it at a lower temperature, and bringing it off cooler, expedites the process, saves the fuel, and improves the quality, adding purity and strength to expedition. Purity is strength; for instance, in proportion as spirit is impregnated with chary (or any foreign) matter, which gives it the burned flavour of the grain, or adds to its specific gravity, its apparent strength is depreciated, and it appears weaker by the hydrometer.

The flame and heat of the huge mass of fire under the stills now in use, being converged to a focal point under its concave bottom, acting on a massive body of thick wash, supported on the convex surface of a very thick bottom, although well calculated to throw up the boil, and break the head of the distilling fluid in the center of its upper surface, and by dispersing it to the sides, open a passage to the rising vapours, at the same time exposes the larger part of the fluid comparatively at rest, to deposit the grosser particles of the less agitated parts of the distilling fluid on the bottom, which is sufficiently thick and heated to burn or char them, more or less; from whence has un-

avoidably arose the empyreumatic taint already alluded to, and so difficult to correct by subsequent rectification.

The cylindric figure of my still, the manner in which the fires are disposed of under it, and the heat and flame reverberated round, over, and under it, in successive convolutions, impels the heat on all sides from every inch of the circumference to the center or axis of the cylinder, agitates and promotes the fluidity of the whole mass at once, and forces the grosser particles of the wash from the bottom and sides to the center, or axis; by removing them from where they are burned in other stills, to where they cannot possibly be burned in this. The figure and application of the heat in this still, promoting and preserving the fluidity of the wash to the last; the form of which is most completely adapted to a stirring engine of any that has been invented.

This Still, like the Brewing copper, admits of another at top, sufficiently large for a spirit still, to re-distil the spirits of the first extraction, that has been drawn from the wash in the under still. If this should be rejected, either by the *Excise* or the *Distiller*, the under, or first described *Still*, forms a complete *Wash Still*, alone possessed of all the foregoing advantages. A working model of the Still and Refrigiratory, or Condenser, may be seen at Mr. *Thomas Compton's*, Worm-maker, Houndsditch; and models and designs of the other utensils.

REFRIGIRATORY:

REFRIGIRATORY: OR, CONDENSER,

To supply the Place of the Common Worms now in Use.

In the formation of this important instrument, or utensil, of the distilling apparatus, regard has been had to the waste hitherto made of the etherial and most volatile part of the vapour arising from the distilling materials, carried off by the elastic air, generated or extricated in the process, so very perceptible to the sense of smelling in all distilleries, which is here collected and filtered through the coldest part of the condensed and refrigirated fluid, in which it is deposited and saved in future, by a provision made for the purpose in the *New Refrigiratory.*

Very little study of this apparatus will lead us to a knowledge of what daily passes before our eyes, though it may not have been attended to before, and if at all taken notice of, it must be allowed, that it has not been applied; this is the ascent of vapour, of steam, and all vapourous fluids, and exhalations, whether elastic or condensable; they all have this one property in common, of ascending into the atmosphere, in which they float, from being lighter than common air.

With this important fact in view, a little further examination will bring us to a conviction of the error on which the present worm is constructed, demonstrable from this obvious circumstance, that the

vapour

vapour or steam ascending from the boiling wash, or other fluid, into the arm of the still, is now forced to descend down the various convolutions or rounds of the worm, contrary to its specific gravity, through a column of atmospheric air, considerably heavier than itself; to effect which, and also form a partial vacuum in the first rounds of the old worm, an additional force of heat is applied, until the steam or vapour descends low enough to begin a rapid condensation; this may be called the point of stagnation, where the force of the vapour is counterbalanced by the pressure of the atmosphere, which is necessarily avoided by the structure of my Still and Refrigiratory, in which this mutual action and re-action is prevented between the descending vapour within, and the ascending air from without, by averting the pressure of the atmosphere.

And the trouble, delay, and expence, of applying a much greater heat than is necessary to raise the vapour out of the still, and then compress it again to descend through a column of air within, heavier than itself, and overcome the counter-pressure of the atmosphere without, which protracts the process of distilling, over-heats the wash, &c. elevates the grosser particles, and impairs the quality of the spirits of the first extraction in a degree that has seldom been remedied by any succeeding process of cleansing, flavouring, or rectifying, that has yet been applied.

The annexed drawing is a design calculated to remedy the inconveniencies before enumerated, and, for the better understanding the same, a model has been made, explaining the manner in which it acts when at work.

Here the rising steam or vapour is copiously received, and pursues an uninterrupted ascent through the expanding folds, of the *New Refrigiratory*, in which the returning currents of the condensed and condensing fluid form a broad cascade, the whole extent of each fold,

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in their descent, and by coming so frequently in contact with the cloud of rising vapour on so broad a surface, greatly accelerates the condensation.

The difficultly condensible and the incondensible part of the vapour, when arrived at the top fold, is precipitated into a descending tube, which comes down to, and is inserted in, the top fold of the lower range of folds below the chamber of reception, in which the arm of the still is inserted, and there meeting with the accumulated current descending, of its own gravity and increased quantity ; the density of which is increased by the additional coolness from a second exposure to the large space of condensing surface, afforded by the second range of folds, and reduced to the greatest degree of coldness possible.

The cloud of rising vapour from the new cylindric still, which no worm in use could receive and condense, with facility enters the chamber of reception, or more properly the condensing valve, there meeting with an easy ascent, flies upwards to the phenomena of nature, the fluid forming a valve of separation, serves to exclude its progress downwards, until changed from a state of vapour to a state of fluidity, which then gives a free and easy passage to the condensed current.

It appears by the annexed design, that the *New Refrigiratory* is a kind of regular zig-zag, composed of a certain number of flat parallelograms, or flat oblongs or squares, in an ascending and descending chain of connection, that renders it as continuous throughout as the common worm ; or to simplify it the more, it may be aptly compared to a very large worm, or long tube, flatted to two or three inches width, preserving a convexity (outwards) at the sides and ends ; and bent into a regular zig-zag to preserve a proper current within, with the addition of a condensing valve, &c.

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We now come to the further explanation of the *Condensing Valve,* which acts a very important part in the use and application of my *New Refrigiratory,* and the principle on which it is founded. One end of it, that is the large arm or tube, (usually called the mouth-piece in worms) which comes through the worm tub, is to be attached or connected to the arm of the still. The dotted lines described a bent tube which receives a funnelated tube at its center, into which the condensed fluid descends as condensed, and flows out at its upper extremities, and descends through the lower range of paralellograms, which are still flatter than the upper range, and may be less in superficial contents and respective capacity; the condensation being performed above, and the refrigiration (only) here. The lateral tube continued from the bottom of the bent tube, through both condensing valve and the worm tub, serves to fill up the bent tube, with a fluid similar to that to be condensed, before each distillation, and to draw it off when a dissimilar fluid is the object of distillation; soon as this fluid rises into the funnel part of the tube high enough to overflow at each extremity of the bent part, it is known, by appearing in drops or a small stream at the end of the worm or tube at the lower part of the worm tub; this fluid separates the chamber of reception into which the vapour first enters, from the lower range of parallelograms, and forms the valve of separation, the whole of which comprises the condensing valve, and divides the condensing from the refrigirating part of the *New Refrigiratory.*

By the application of this simple contrivance, and placing a valve at the end of the lower, or exit tube, the pressure of the atmosphere is averted, and elastic and non-elastic fluids are conveyed through dense fluids or liquids, or the vapour is passed one way, and the condensed liquid another, agreeable to the phenomena of nature, the laws of gravity and expansion, and the vapour ascends in conformity to its own levity, forming a *New* and *Improved Principle* in the process of distilling, by which the process is securely accelerated, and the whole of

of the volatile parts saved, hitherto dissipated in the atmosphere, to the injury of the flavour, quality, and strength of the distilled spirit.

My Condenser, consisting of two plates formed in a zig-zag fold, the interstice between which is the flatted tube or condenser, by the addition of another plate forms two flatted tubes or a double condenser, and the addition of a fourth plate, a triple flatted tube or zig-zag condenser, applicable to many useful purposes, the annexed sketch of which will prove their practicability: when I have demonstrated my mode of converting water to steam or air at pleasure.

This double condenser may be used without a worm tub, and nothing more is necessary than to cause the vapour or steam to ascend or descend, through or between the two outer folds, while cold water is passed between them through the middle fold.

Or it may be made to serve two stills, by placing it in a worm tub, and passing all the water for supplying the tub through the middle fold.

Or it may be made to condense for one or two stills without a drop of water, by passing a current of atmospheric air instead of water with a velocity sufficiently great to counterbalance the difference of density, or gravity, between air and water, which last is eight hundred and fifty times heavier than the former. This is accomplished by causing this air to supply the combustion of the fire under its correspondent still; or finally, it may be made to condense for both the wash and spirit still at once in more ways than one.

COOLING ATTEMPERATOR.

This epithet, as here applied, is only another word for cooler. The single, double, or triple *New Refrigiratory*, may be rendered eminently useful to malt-distillers and brewers of every description, for *cooling the worts* with the *utmost dispatch*, to the temperature of the atmosphere, or to any required pitch for fermentation, in any given time, either by *air* or *water*; and when employed in this way, they should be called Attemperators. First, by filling the middle interstice with the *hot worts* from the under hop, or jack back, and obliging the *air* consumed by the fires under the copper, still, or steam-engine, to pass through the two outer folds. Secondly, by filling the two outer interstices with *hot worts*, and passing the air through the inner, or middle fold; instead of air, water may be applied in a similar manner. Lastly, by placing the single, double, or triple refrigiratory in a worm-tub, supplied in the usual way with *water*, as practised by the distillers, (or in a round, square, or oval vat) and filling up the refrigiratory with *hot worts*, where they must quickly deposit their heat, and are soon brought to the temperature of the atmosphere, (or even lower) by a continual supply of *dense air*, or *cold water*; the *hot water* serving to supply the copper for the next mash; and the refrigiratories, or attemperators, are cleansed with greater facility, and more effectually after the worts, by steam, than the coolers have hitherto been by any other method, as may also the close mash-tuns, or any other vessel or close cask whatever.

The temperature of the worts, wash, or Must, or other fermentable fluid, is easily known by the thermometer, and when cooled as much

as they can be in the common coolers of the brewhouse, are usually found to be nearly that of the incumbent atmosphere.

In sudden changes from cool to mild, or to warm weather, the temperature of the atmosphere may be too much above the wished-for degree, to immediately commence a beneficial fermentation; yet these worts must descend into the gyle-tun, or fermenting-back, to make room for others, where they must necessarily be fermented, for the same reason, and to prevent a spontaneous fermentation, &c. being generated by their quantity, depth, and heat.

Either my fixed or moving Attemperator immediately corrects this inconvenience, and obviates the consequent injury, by imbibing and carrying off the redundant heat, and exactly attemperating the worts, wash, &c. to the required degree, with any desired expedition, and preserves them during the whole process at the requisite temperature. At the same time the worts are wholly prevented from imbibing from the air a tendency to *acidity*, by having the whole substance of the fluid exposed to the influence of the atmosphere, at no greater depth than from one to two or three inches deep, on the extended surface of the broad coolers now in use, by which they are *oxygenated* or *acidified* in the *cooling;* to the advantage of avoiding which, they will be found to owe much of their future preservation or keeping quality, with respect to the brewer, and totally obviate their present tendency to *acidity* in the distillers' fermenting back, to which their long protracted fermentation very much exposes them, after such atmospheric exposure in the coolers, and by which injury they incur a proportionate decrease of spirit, that we shall hereafter endeavour to compensate in the works of those who may not immediately adopt the Cooling Attemperators, Spiral Pump, &c. The further description and application of these important utensils may be seen under Attenuation, or the Doctrine of Fermentation, and under the articles *Refrigiratory,* moving and fixed Attemperator, &c.

 The

The *Cooling Attemperator* in conjunction with the *Spiral Pump*, may be advantageously employed to cool the worts in their passage from the copper to the jack-back, gyle-tun, &c. to any degree of temperature necessary to pitch the fermentation at, in the gyle-tun, or fermenting-back, by the assistance of the *Spiral Pump*, aided by cold water, or dense air; the latter is always preferable to the former, though ever so plenty, as the former requires much time and labour to raise it.

It appears, by calculations to be brought forward in this work, that the quantity of air necessary to support the combustion of the fuel expended under the copper, still, steam-engine, &c. is fully adequate to the cooling of the worts, wash, &c. brewed at the time.

Which is performed in this manner; the cold or cool air, at the common temperature of the atmosphere, is admitted from without the brew-house, still-house, &c. at any convenient place, through a suitable apperture or opening, and conducted by a canal or passage, sufficiently large for the purpose, to the ash-pit of the copper, still, boiler, &c. By exactly closing the ash-pit with an iron door and frame, to exclude the entrance of air through it, or in any other way than by the canal; and having it so contrived, that the air must pass through one or more interstices of the *Cooling Attemperator*, the current of which will move with a velosity more than sufficient to compensate for its rarity or lightness compared to water, which is eight hundred and fifty times heavier than air, as before observed.

Attracted with a vehemence proportioned to the quantity of fuel inflamed or burning at one time under the copper, still, boiler, &c. the *Cooling Attemperator*'s broad folds of metallic matter, and the number of folds through which the worts or wash are passed, have their heat imbibed and carried off by the continual and rapid current of air rushing impetuously on, to support the combustion of the fire under the

the copper, still, boiler, &c. from its contact and passage over and under every inch of the metallic folds of the *Cooling Attemperator*; metals being the best conductors of heat, quickly absorb and carry it off as soon or sooner than cool or cold water, from the constancy and frequency of its application to the surface of the metal, and the velocity of its motion, without the trouble or expense of raising water; the numerous impulses of a weak force operating more effectually than the sudden impulse of a great force. This may be regulated with proper sliding cocks to turn the air off and on at pleasure, so as at the same time to regulate the application of the burning fuel to the vessel to be heated, to the greatest nicety imaginable, lowering, raising, stopping, or even extinguishing the fire at pleasure. While the fire of the copper is damped, the current of air to the engine may be turned on, by the brewer, and that of the still and engine, both by the malt-distiller, and so alternately, as occasion requires. And when the passage of the worts from the copper to the jack-back is not sufficient to wholly cool them, they are perfectly cooled in their ascent through the *Spiral Pump* to the gyle-tun and fermenting-back.

In Cleansing, the application of the *Cooling Attemperator* is inestimably beneficial, when the cooling is performed by the assistance of a current of air in the manner proposed, from the softness, mildness, and gentleness of its cooling, over the application of *cold water*, which, from too suddenly and harshly chilling the fermenting fluid, might precipitate and convert a greater part of it to grounds, than the milder application of air as proposed, which would destroy the advantage intended by cleansing in quantity, and expose the fermenting fluid to all the inconvenience to which the sudden cooling in barrels, &c. are subject. The loss of strength, and the perishing of a much greater quantity of the fermenting fluid, and a greater tendency to acidity from so large an exposure to the atmosphere, all of which are most effectually remedied, and every possible advantage derivable from *cleansing*, obtained by employing my *Cooling Attemperator*, worked with

with the air consumed by the fuel burnt in the operation of brewing, &c. without the expense or room taken up by coolers, or the hazard of imbibing acidity from the present large exposure of the worts to the action of the atmosphere, so thinly spread out as they necessarily must be in the broad coolers now in use. Nor is the *Cooling Attemperator* inapplicable to the preservation of the beer or ale, when started into the *Store Vats,* where it not unfrequently heats, ferments, or works again, from the quantity impacted together, in one respect, and in another, from different brewings being added to each other, and often, indeed mostly, at different temperatures; all which contribute to foul and acidify the beer or ale so treated, and all which we shall in future prevent, though ever so many brewings should be impacted together in one vat.

Although the figure of the Cleansing Vat is not of much importance, where the Cooling Attemperators of a zig-zag form are used, nor the quantity in each; yet both may be of consequence to those who have already began to deviate from the old manner of cleansing in barrels, half-hogsheads, butts, &c, and find the advantage of it. They should have Attemperators adapted to the form of their cleansing vats, circular, oblong, or perpendicular, ascending, or descending, to suit their mode of cleansing. See Plate, containing

VARIETY OF PNEUMATIC OPERATIONS.

VARIETY OF PNEUMATIC OPERATIONS.

The Boiled Worts cooled in their Passage from the Copper to the Gyle Tun, by *Air* or *Water.*

B C the Brewing Copper.

L B a Liquor Back, or Gyle Tun.

s t a Spiral Tube in ditto.

G T, C V at one time represents a Gyle Tun; at another a Cleansing Vat.

c t u b, the Passage of the boiled Worts from the Copper to the Under Back.

S P a Spiral Pump to cool the Worts in raising to the Gyle Tun from the Under Back.

u b an Under Back.

a a Air-cocks to regulate the Air for cooling the Worts in its Passage, and to shew the Course of the Air to the Ash-pit of the Fire-place.

The Fermenting Beer or Ale cooled in their Passage from the Gyle Tun to the Cleansing Vats, and kept in them at a proper Temperature, by *Air* or *Water.*

L B, G T at one Time represents a Liquor Back; at another, a Gyle Tun.

S P a Spiral Pump.

u b an Under Back.

G T a Gyle Tun.

M A a Moving Attemperator.

a or *w* Air or Water Cocks.

o v an Organ Valve.

S V a Store Vat.

Pn. M F a Pneumatic Moving Gas Furnace at work.

f the Funnel.

f p the Furnace-pipe.

f p t the Passage of the Generated Gas into the Gyle Tun or Cleansing Vat.

a p a the passage of the Air to the Ash-pit.

f the Fire-place.

F A a fixed Attemperator.

m m m Man-holes.

RECTIFIERS' STILLS.

WHAT has been said on the *Stills*, principally applying to *Wash Stills*, I shall here take the Opportunity of partially touching on the merits of my still as a Spirit, or Rectifying Still.

A Cylinder with double ends forms a most commodious spirit still for the rectifier. To say it was equally safe from fire as the stills in use, would not be barely doing justice to it, as an inspection of the model must convince the most scrupulously cautious of being infinitely more secure.

As a rectifying still, most of the advantages of the wash still attach to it, even when used without the additional still at top: but when united, those advantages multiply, the raw spirit is then conveniently rectifying in the lower one, or the distillation of gin is performing in it, at the same time the compounds are making, or the rectification of spirit of wine going on in the upper still, with the same fuel and attendance.

With respect to the West Indies, where fuel is always dear, and water often scarce, those stills and refrigiratories will be a treasure; as the condensation and refrigiration can be performed in them, with little fuel, and with or without water.

The remainder of the Utensils will be found in a subsequent part of the Work.

MALTING IN THE GYLE TUN,

Or, in other words, effectually to dissolve the whole farinacious substance of the unmalted grain, by turning the *liquors* over at a proper *heat*, so as, at the same time, to insure the not *setting* of the *goods*, from the tendency the farina, or flour of the grain, has, in certain degrees of heat, to coagulate, or form a pasty substance, incapable of composing the requisite worts, either in quantity or quality, usually called making a pudding, which prevents the spending of the taps, one of the most embarrassing accidents that can occur in brewing.

That this can be commodiously and safely done with mixtures of malted and unmalted corn, or even with all unmalted corn, a few trials will peremptorily decide.

Very little reflection must lead the way to the certainty of this, when we look back on what has been said on the properties of malted corn. Could I but put the intelligent brewer upon the right mode of reasoning, or upon reasoning at all, conviction must necessarily follow; for instance, let him ask himself, Are not worts the flour of the malted or unmalted grain, dissolved in water? If he could be so ignorant of the nature of things, as to hesitate or doubt it, let him take wheat or barley flour, and dissolve it in warm water, for the starch-makers will tell him that it cannot be done in cold water, and ferment this solution, and it must extort conviction.

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Hence it will be obvious, that a complete solution of malted or unmalted corn, or of mixtures of them, is practicably obtainable; and when obtained, the quality of the future beer, ale, &c. they are destined to compose, will very much depend upon the subsequent fermentation.

Malted corn, we have seen, from having previously undergone that degree of fermentation, called malting, is more disposed to spontaneously ferment, by a change of temperature in the cooler, the evils awaiting which may be seen in the Doctrine of Fermentation, and in the subsequent practice, where it will be found to require a less vigorous fermentation than unmalted corn, or than mixtures of them.

Therefore, the unmalted worts, or mixtures of them, or what is the same thing, worts drawn from mixtures of malted and unmalted corn, may with greater safety be conducted through the process of fermentation, and the subsequent cleansing, starting, &c. under change of temperature, hitherto so incommodious, and sometimes fatal to the gyle: it may be even pitched without danger, at a much higher temperature; and when pitched as low as usual, admit an additional quantity of yeast, to make up for the deficiency of malting, to develop the unwasted strength and vigour of the grain, unimpaired by malting.

It has been before defined, that badly malted corn consists of malted and unmalted grain; hence the only difference between badly malted or partly malted grain, and mixtures of malted and unmalted grain, lays in each grain of corn in the one case being partly malted and partly unmalted; and in the other, that a portion of grain wholly malted, is mixed and brewed together with another portion of grain which is wholly unmalted; only in the latter case, we can be more exact in proportioning them to the object in view, than in the former, and consequently render them more subservient to our purpose.

Hence,

Hence, they may be so exactly ascertained in this way, that we can always ensure the quantity of the mixture, flavour, quality, and strength we have in view, as in the one, we know measure for measure what we have of each, and not in the other.

There are three ways of managing this business: First, as barley and malt are not exactly soluble by the same treatment, they may be brewed separate, and the worts brought together in the tun in due proportion. Secondly, they may be brewed together, by mashing the barley grist eight or twelve hours before the malt is added. And, lastly, by mashing them alternately cold and hot together.

With regard to flavour, I do not pretend to say, but, that much of it depends upon the subsequent management of the fermentation, as well as in the first formation of the grist, and taking the heats of the liquors; I only mean to represent this to be the more safe and certain way of the two, of commanding flavour, quality, and strength, with certainty and advantage.

And by an augmented fermentation in the gyle-tun, to wholly or partially, as the case may be, compensate for malting; instead of it being injurious, to render it advantageous in every stage of the business, and much more profitable in the length; which we may define to be the soul of brewing.

The discerning reader may make this enquiry, if we brew raw corn and pale malt, how are we to supply the colour and flavour of brown and amber malt? to the disuse of which, you attribute so much in your description of the decline of porter? To which I beg leave to reply, with regard to colour, as before observed, it began to be used about forty years ago, and has increased in use ever since, and always in proportion as pale malts have been employed for porter, and the use of brown and amber malts declined.

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This colouring matter is obtainable from either brown malt, soft sugar, or molasses. I composed my colouring principally with high-dried brown and amber malts, which answered my most sanguine expectations, supplying both *colour* and *flavour*.

As hot liquor is the solvent of the high-dried and candied malts, I concluded, that hot worts might have a similar effect; but until tried, I could not know how hot water, already saturated with the farina of the grain, might act, or that it was capable of imbibing flavour sufficient, even in a boiling state; but considering how much hotter boiling worts must be, in proportion to the fermentable matter they contained, than boiling water, I rested my hopes on this reasoning, and succeeded according to my expectation, and with a much less quantity than I could possibly expect; a few trials corrected and adjusted the whole to my entire satisfaction. The undissolved bran, or husk, of the grain mostly remaining with the hop-seed and hops in the hop-back, proved of no inconvenience.

At any time when the worts are not sufficiently flavoured in the copper, they may be improved in the gyle-tun, by the addition of a suitable quantity of coarsly-ground amber and brown malts, gently boiled, previously cooled, and roused in soon after the last wort is let down. Here we advantageously imitate the judicious Vintager in improving his colour and flavour in the wine-tun. See Appendix.

Those who are determined to obviate all possibility of doubt, in securing flavour and colour, as well as strength and length, may employ the usual quantity of amber and Hertfordshire brown malt, in their essays of using raw corn; first gradually diminishing them in proportion as they succeed in giving *flavour* and *colour*, by the means proposed, both in the copper and gyle-tun, and by so doing obviate the danger of failing when working on a large scale.

The following observations, founded on fact, and hinted at before, should be reiterated here: First, that every grain of corn or other seed capable of reproducing its likeness, must be submitted to the earth and subsequent vegetation in a living (that is) a sound state, or there can be no reproduction, or produce. Secondly, that malt having undergone a partial vegetation, sufficent to exhaust its vital principle, could not produce grain. Lastly, that unmalted corn, being in full possession of all its vital powers, is not only stronger, and contains more nutritious, and fermentable matter; for these reasons it produces beer more capable of keeping longer, and in higher preservation, than when full malted. This must be an obvious conclusion, even if I had not proved it by experience. And, if we look back into the history of Porter, we shall find this confirmed, that beer brewed when malting was less understood, and consequently the grain less malted, kept longer, and in higher preservation, than at present. See Book the Second, Comparative Observations on malted and unmalted Corn

THE WORKING TUNS AND FERMENTING BACKS.

It is at present pretty generally the practice to have partially close working tuns and fermenting backs, particularly among the malt distillers; but we have recently seen, that they are as necessary to the brewer, and in future that they should not only be water, but air-tight also: for this very simple reason, that all fermentable matter is composed of air, or, in other words, of elastic fluids, or air (which has been previously explained in the definition of fermentation) hence all fermentable fluids are resolvable into air, and absolutely do resolve themselves (more or less) into air, during ths process of fermentation, and

are

are the cause of intestine motion in the fermenting fluid. For these very obvious reasons, I have stated in my definitions of the distilling apparatus, that the atmosphere is the solvent, and receptacle, not only of aerial but of fluid and solid bodies. The atmosphere, in fact, owes its formation and existence to this cause!

When I state that all fermentable fluids are resolvable into air, I do not confine myself, in this observation, to fermentable matter only, for all matter is resolvable into elastic fluids or airs of different kind; this will be easier to conceive, when we consider, that all matter exists under the form of solids, liquids, or air. This may be instanced in water, which in a temperature below the freezing point becomes solid, for ice is water in a solid state; at a temperature above this point it becomes fluid; this temperature raised to the boiling point resolves water into vapour, which becomes soluble in the atmosphere into which it is constantly ascending: a still higher temperature (it has been seen) decomposes it, and resolves it into two elastic fluids, hydrogen and oxygen, or inflammable and vital airs; these airs or gasses burnt together in certain proportions, recompose water. And we may add, that earths, stones, and metals melt, or are fused at different temperatures; and at higher temperatures, are resolved into air.

Notwithstanding the justness of this definition, I alledge, that all these operations effected by chemical assistance, are producible by natural means in the common temperature of the atmosphere, in the lapse of time, and are hourly carrying on by nature; which mutation of matter is one cause of the various and sudden changes of the temperature of our atmosphere, which we and all created matter experience, and which is so materially visible in all fermentable fluids, whose fluidity and spontaneous tendency to decomposition, renders them the more susceptible of those changes, and that in proportion to the heat and gravity of their contents, in conjunction with quantity.

With

With respect to the influence those changes have on fermentation, both spontaneous and excited, particularly the latter, in which we are so much interested, I have traced them *cause* and *effect* through their various gradations to imperceptibly inform the mind, and impress rational notions of these things, by leading them from fact to fact, the better to enable us to conceive and apply the means I have to offer for obviating the inconveniences, and guarding against the influence of these changes, not on visionary, but on rational principles, derived from experience and the known phenomena of Nature.

To expand our ideas, and develop the admirable workings of providence in the extensive and the uniform operations (of nature), to preserve our globe by the equilibrium and indestructibility of matter under all those changes described; and to shew how necessary to success, and convenient for our instruction it is to recur to first principles, and take nature for our guide, in every imitation of her wonderful works. That, in all our operations, which cost us so much trouble, and on which we expend so much fuel, she with the most beautiful simplicity performs by a few changes of the atmosphere which circuminvolves our globe, by the agency of light acting upon the few elements of which all matter is composed.

Thus led to a notion, if not a conviction, of the composition of our atmosphere, and of its being the solvent and receptacle of solid, liquid, and aeriform bodies, and consequently of how much it must influence the doctrine of fermentation, and of the expediency of our employing air-tight casks to perform this important operation to the greatest advantage, we proceed to the delineation of the necessary apparatus.

WORKING TUNS, OR GYLE TUNS.

The figure of the working tun is not of much importance, whether round or oval, square or oblong, but it is necessary that it should be sufficiently large to give the fullest room to the head of yeast or barm to expand, so as but barely to reach the head or top of the vessel when there is no barm-safe; and that it should be strong and air-tight in all its parts. When not convenient to enlarge them they should be provided with a barm-safe, hereafter described.

Strength and unity of parts in conjuncton with being air and water-tight is procurable with the greatest certainty in an iron-bound cask or vat; the malt distillers' fermenting backs, which are but so many large casks or working tuns, in various gradations of fermentation, to succeed each other in a regular progression necessary to their business, is the best form of all the casks or vats in use for a brewer's working tun; and requires no alteration in figure or strength, for adoption of the major part of my improvements in the doctrine of fermentation, and to which we can commodiously apply our *pneumatic apparatus* to co-operate, jointly or separately with our impregnation or combination, and as commodiously add the barm-safe.

MOVING ATTEMPERATOR.

F, an *Attemperator* for the use of the brewer and malt-distiller, for regulating the temperature of worts, wash, &c. so as partially to obviate the impressions the changes of the atmosphere make on fermenting fluids: *a b c d f* the attemperator; *a g* the receiving tube, with

with its proper funnel; *f b* the delivering tube; *c a* the charging shoot, to supply the *attemperator*; *b c* the discharging pipe, with its proper tube or funnel. For the delineation of the structure of this *attemperator,* we must refer to the condenser of the distilling apparatus; and for its application and use, to the *fixed attemperator* of the *cleansing vat* A X.

This *attemperator* can be transferred from working tun to working tun, and from cleansing vat to cleansing vat; and from fermenting back to fermenting back, with the power of procuring any degree, or increase or decrease of temperature wanted, in order to preserve an equilibrium of temperature in the fermenting fluids, or counteract the influence of atmospheric changes; *h* a discharging cock for emptying the attemperator, that screws on and off near the bottom, therefore not visible, as it would then be in the way of moving it from vessel to vessel.

The *Temperature* of *Worts, Wash,* or other Fermentable Fluid, is easily known by the *thermometer,* and usually found to be near that of the atmosphere, when cooled as much as they can be in the common coolers of the brewhouse.

In sudden changes from cold to mild, warm, or hot weather, the temperature of the atmosphere may be too much above the wished-for degree to immediately commence a beneficial fermentation, yet these goods must descend into the *gyle-tun* or *fermenting-back* to make room for others; where they must necessarily be fermented for the same reason, and to avoid a spontaneous fermentation being generated from their quantity, depth, and heat.

My fixed, or moving, *attemperator* immediately corrects this inconvenience, and obviates the consequent harm, by imbibing and carrying off the redundant heat, and exactly attemperating the worts, wash,

&c. to the required degree, with any desired expedition, and preserve them, during the whole process, at the requisite *temperature*. For changes from warm or hot to cold, see *Cleansing Vat*.

BREWERS' CLEANSING VAT.

The temporary expedient of the *Porter Brewer*, &c. for breaking the force of the fermentation in the *working tun*, and subsequently *cleansing* of the beer, has usually been to draw it off into barrels, placed upon stillion-troughs, to receive the dregs separated by the cooling and consequent condensation of the fermenting fluid thrown up and discharged at the surface: to supply the waste of which the casks are kept filled up with some of the same beer reserved for that purpose; this is a *purgation* necessary to the transparency of the beer, obtained in this way by the numerous division of its parts and subsequent coolness, that is found to allay the heat which the whole mass had acquired by a vigorous fermentation in the working tun, which, if not timely checked by this kind of treatment, would quickly tend to the acetous process of fermentation, than which nothing could be more contrary to the intention of the *Porter Brewer, Ale Brewer*, &c.

The obvious motive for dividing, and thereby cooling the fermenting fluid, is the impracticability of bringing about a separation of its parts, and consequent deposition of its feculencies, with the same degree of heat generated by fermentation, which, if kept up, could not be effected; but the acetous fermentation would be excited by the *heat* and *turgency* of the fermenting fluid.

With

With the laudable view of improving this part of the process, and preventing as much as possible that part of the fluid perishing that works off with the dregs, a more beneficial and workman-like mode of doing it has been attempted by some of the principal brewers, by substituting large vessels called *cleansing vats,* in which the beer, though somewhat more divided than in the *working tun,* yet is infinitely less than in the barrels, the former containing several hundred barrels each. Part of this intended improvement was calculated also to save the immense trouble attending the old method of *cleansing.*

This well-intentioned attempt is defeated for want of a judicious arrangement to co-operate with the intended improvement, so as to obtain the end in view, but at the same time make it the instrument for obviating the influence the changes of the atmosphere have on the fermenting fluid.

By cleansing in quantity, the *strength* and *spirituosity* of the beer, properly procured in the working tun, can be better preserved in the *cleansing vat,* and less of its substance perish, by the more gradual separation of the parts to be thrown off, than obtainable in the barrels. The beer or ale after due attenuation being transferred from the working tun to the cleansing vat, will turn out stronger or weaker, according as duly managed there; the two quick cooling, and consequent condensation in the barrels frequently reducing the strength, while the mass in the *cleansing vat,* by preserving the heat too long, may as often produce acidity instead of strength, which changes the principle of the *inflammable spirit* to an *uninflammable substance or acid,* and defeats the obvious use of the *cleansing vat.*

CLEANSING VAT ON AN IMPROVED PRINCIPLE, WITH A FIXED ATTEMPERATOR.

B. the cleansing vat; *a b c d* a broad flat, zig-zag tube, entering in at *a* and descending in a zig-zag form within the vat to *d*, and from *d* to *c*; and ascending from *c* to *b* in the same manner, clearing the edge or upper rim of the vat at *b*; *a* the funnel for conveying air or water into the tube *a b c d*; *b* the end of the tube for letting those fluids off; *c* a cock outside of the vat communicating by a short tube into the vat, and forming a junction with the most pending part of the tube *a b c d*, for either drawing air or water off, and for trying the temperature of either with the *thermometer*; *d* a tube communicating with the tube as *b c d* at *f*: to the outside of the vat a cock is fixed at *f*;* *a c* the spout for passing water into the zig-zag tube *a b c d*; the whole of this apparatus forms the *attemperator*.

When the fermented fluid is cleansing in this vat, from its not having the advantage which the barrels enjoy, of being so much divided and consequently cool, and for these reasons less influenced by the impressions of the atmosphere, and sudden transitions from cold to mild, or mild to warm weather, which at present more than counterbalances the advantage it otherwise has over them.

To render it subservient to the purposes it was intended for, this cleansing vat must be fitted up with the attemperator before described, which being composed of metal is the more susceptible of the changes of the atmosphere, which, by turning the cock *c* at any time, will inform us of the temperature of the cleansing fluid, by applying the thermometer to the air or water let off, and in what degree it corresponds with, or recedes from the temperature of the atmosphere, and whether we are to pass air or water that is cold or hot to preserve the equilibrium.

When

* See A X 3.

When the *barometer, thermometer, electrometer,* &c. informs us of the present state, or gives notice of the approaching change of the atmosphere; if the change announced is from cold to mild, it must be provided for by impelling a current of air or water that is cold through the attemperator; if from mild to cold, then the current impelled must be of warm air, steam, or water, to obviate the expected change. Steam in proportion to the distance it comes, and the air that accompanies it is the best.

This is done by applying the nosle of the bellows, or *Pneumatic Engine X* to the cock *d,* and turning the stop-cock *d* to admit the air, &c. or by shutting the cock *d,* and admitting the water from the shoot *c a* at the funnel *a,* which spontaneously flows off at *b c,* from a known law of hydrostatics, by which water rises to nearly the same height in tubes that it comes in at; on which principle depends the conveyance of water by aquaducts.

Hence the stream of water conveyed by the tube *a* descends through the funnel *a* to *c,* and ascends from *c* to *b,* which being considerably lower than the entrance *a,* runs off at *b c;* a constant stream being kept up by this means, the beer in the cleansing vats may be regulated to any temperature. A current of cold air may be either excited or attracted in its application to this purpose.

In sudden changes of temperature from mild to cold frosty weather, when a beginning fermentation is suddenly checked by the quickness and intenseness of the transition, and an augmentation of temperature being indicated, warm air or water, steam, &c. must be substituted to cold, until the sudden change of the atmosphere is counteracted.

When changes of temperature from cold to mild, or from mild to warm weather, are foreseen by the barometer, electrometer, &c.

warm

warm air or water may be provided ready to apply and counteract the approaching change, with both which the brewer and distiller is always provided, either from the coolers, steam-engine, or worm-tubs, and by occasionally consulting the attemperator, their application may be regulated ; or the airs, water, &c. may have their temperature changed by means correspondent to the effect, to be hereafter enumerated, either by passing them through the tubes, &c. immersed in the fermenting and fermented fluid, or by immediately blending the requisite air with the fluid mass, in order to attemperate and impregnate at the same time, in the manner best suited to the effect intended, of either hydrogenating or oxygenating it.

Hence it appears that the *turgency* and *heat*, necessary to fermentation during the attenuation of the fermentable matter, is not only unnecessary but injurious when the attenuation is carried to the requisite height different beers and ales require. And when attenuation is very high, and fermentation very rapid or vigorous, if not properly checked, it brings on acidity.

And that *coolness* and subsequent *transparency* are the effects of *racking* off, and *cleansing* ; that heat and turgency is only necessary in the *vinous fermentation* during *attenuation*, and injurious beyond that point when acidity is not the object in view ; and though injurious beyond a certain point in the *vinous*, is absolutely necessary in the *acetous fermentation* ; this shews how prejudicial the sudden changes of the atmosphere are to those intentions, if not duly foreseen and guarded against, which is one beneficial effect of counteracting the influence those changes have on the fermenting fluids. And also how necessary it is to mark the limits, and accurately distinguish when to stop the progressive force of fermentation, at such a period as shall best answer the brewer's purpose, in making a perfect, uniform, and spirituous beer or ale, *full, well-flavoured,* and transparent.

THE PRESSURE OF ELASTIC FLUIDS AVERTED, &c.

We have seen in the Description of the Distilling Apparatus how the pressure of the atmosphere is *averted;* it remains now to be described, how the pressure of other elastic fluids are to be averted, or usefully applied; this shall be presently done by a contrivance still more simple if possible.

A B a *Store Vat,* or *Gyle Tun,* with a moving attemperator, that is, a vessel apropriatable to either of these purposes; *a b* two tubes communicating from one end of the vat to the other; *a* the top, and *b* the bottom communication to each tube; *ccc* three cocks in each tube; *d d* two stop-cocks on each side; *d* the uppermost of the two stop-cocks *d d* to cut off the communication between the upper and lower part of the vat, if employed as a gyle tun, with a moving or shifting attemperator, when impregnating the fermenting fluid with its own carbonic acid gas, or fixed air, or any other component gas or air; *d* the lowermost of the two stop-cocks, to cut off the communication between the two lowermost injecting cocks *c c,* to prevent the fermented fluid ascending up the tube *a b* from *d* to *c,* when the vessel is employed as a *store vat;* *o o* a metallic cup, or injecting valve, placed over the extremity of each tube *a b* at *b* to *avert* the pressure of the fluid or liquid during its impregnation; *v* the safety valve. The gas or air passing through the injecting tubes *c c* near the bottom of the vat comes into the averting cups at *o o,* and displacing the liquid in the cups, is received with facility during the injection, and freely and uninterruptedly flows out all round the rim of the inverted cup, wanting no stimulus greater than its own levity to ascend and disperse in all directions in that ascent, attracted and imbibed by the contained fluid, the safety valve *v* announcing when it is saturated, by the redundent air forcing the valve.

The

The great height or depth of the stock or store vats, from twenty to forty feet, or more, may be thought an impediment to forcing the airs in and up against so great a column of liquid.

If this difficulty really existed, applying the *averting cups o o* and the injecting valve *p p*, wholly removes it, by discharging that pressure; how this is performed may be seen by inspecting the engravings A B C D E F, and the situation and office of the *inverted cups* and injecting valves, for averting the pressure of the incumbent weight, and by adverting to the definition just now given both in the explanatory engravings and their concomitant explanations, amply describe the apparatus, and manner of applying the *different gasses,* that are to effect these desirable purposes.

C D E or F * a Gyle Tun, or Fermenting Back, with a fixed attemperator; being one vessel with two bottoms, separating it into two parts; *a b* two tubes of communication, one on each side; *c* a lock-cock, communicating with the gyle tun, or fermenting back, *a d a d*, or upper part of the vessel as *c d*; *d f* two tubes of communication for the lower part of the vessel, as *p l*; F A the fixed attemperator; *f f* the cock on each side, communicating with the attemperator; *h h h* the ascending and descending tubes; *c h* and *c h* entering and exit tubes, for the air, steam, &c. to pass in or out; *f* a discharging cock; *a* the upper, and *c* the lower cock, for applying the pneumatic engine for impregnating the fermenting fluid with its own carbonic acid gas, or any other gas whatever; *o o* the metallic *averting cups; v* the safety valve, with its bell to give notice of the vat being surcharged with fixed or any other air, either generated or injected. In proportion as the safety valve is more or less forced, the bell will ring more or less vehement.

In gyle tuns and fermenting backs, the cups for averting the pressure of the super-incumbent fluids cannot be wanting so much, being

* See A X, of which there are three Plates.

being rarely more than one-half, or two-thirds, full, exclusive of not being near so high or deep as the *store vats*. Moreover the suction of the pneumatic engine, in drawing out the fixed air from off the surface of the fermenting fluid, at the instant of its return, or being impelled into the fluid in the same vat near its bottom, takes off the impression of the elastic fluid above, and helps to discharge the weight of the column of fluid below, by inviting the ascent of the fixed and other airs impelled in at the bottom, which, from its own *levity* or *specific lightness*, is disposed to ascend.

By this invention, the strength of the fermenting and fermented fluids is promoted, by saving and concentering that gas which was formerly lost into the body of the fermenting fluid. Beer grown flat is resuscitated or recovered; and all beers and ales rendered spirituous. The method of recovering and sweetening sour beer and ales shall presently be explained, and how to accomplish it, with equal certainty, facility, and success; the utility and importance of which must strike every practical man, who will easily conceive the means of correcting most, if not all, of the disasters now common to brewing and fermenting, by the light of my improvements, which it is hoped cannot fail to inform the intelligent mind, and extort conviction even from the untractable.

GYLE TUNS WITH A BARM SAFE.

Yeast is an article of so much importance to the brewer, distiller, vinegar-maker, baker, and majority of those concerned in fermentation, as to afford considerable profit on its sale; it therefore demands our attention.

As the adoption of close gyle tuns might seem to trench upon these profits, in order to avoid any such objection to them, each gyle tun may be provided with a *barm safe,* to be attached to it, or the *cleansing vat,* when the latter is preferred to cleansing in barrels.

Engraving, No. 3. Plate III. A *Brewer's Gyle Tun* and *Barm Safe,* complete. A the tun; B the safe; *a b* a leaden or pewter tube, inserted in the gyle tun at *a* and *b,* being nearly its whole length, or height, with four cocks in it; *g h* a similar tube, reaching from the top of the barm safe to the opposite side of the gyle tun, inserted in the former at *g,* and in the latter at *h,* with two cocks in it; *f f* a communicating tube, connecting the barm safe and gyle tun together; *z* a stop-cock to cut off the communication; *y* a discharging cock in the barm safe, to let off the yeast; *Q* the discharging cock in the gyle tun to let the fermented worts off; *e* an exhausting cock, to draw off the fixed air; *c* an injecting cock, to impregnate the fermented fluid; *x* both an exhausting and injecting cock; *v* the safety, or injecting valve in each vat; *v v* valves to pass air and prevent liquids passing; *o o* the inverted cups, or injecting valves; *m m* manholes; *i i* the height the barm or yeast may probably rise to.

IMPREGNATOR,*

For impregnating and improving beer, ale, wine, &c. and restoring them when *flat* or *sour,* giving pungency, transparency, and strength, *and for bringing them forward.* Engraving, No. 3. A the impregnator, or vat, complete; *a b* and *g h* a tube on each side, nearly the whole height of the vat; *e* an exhausting cock to draw off the fixed air, &c.; *d d* stop-cocks; *c ff ff* injecting cocks; Q a discharging cock;

* See the above Plate.

cock ; *a* both an exhausting and an injecting cock ; *k k* the height of the fluid to be impregnated during impregnation ; *i i* the height the fermenting fluid may probably rise to in the barm safe, if used for that purpose ; *v* the vent valve and bell ; *v v* the valve to admit air, or any other elastic fluid, and prevent liquids passing ; *o o* the inverted cups ; *m* the manhole.

An *impregnator* is only necessary for the immediate recovery of beer, ale, &c. that is sent out soon after impregnation ; when that is not the case, they can be impregnated more conveniently in the *store cask* or vats that contain them, without *racking off* into an impregnator to preserve *fineness*, as the impregnation usually has the property of restoring *brightness* or transparency, notwithstanding it being administered to the liquid to be impregnated on its *lees* or *grounds*.

VINEGAR MAKERS' GYLE TUN.

For promoting the vinous and acetous fermentation, and giving pungency and strength to vinegar. A the vat ; *a b a b* two tubes of nearly the height of the vat inserted at *a* and *b* each ; *c c* exhausting cocks ; *d d* stop-cocks ; *c c* and *ff ff* injecting cocks ; *m* the manhole ; *o o* the inverted cups or impregnating valves. See Impregnator, Gyle Tun, and Cleansing Vat, in the engravings.

If it is meant that the fluid to be impregnated should circulate in the vat, to facilitate that intention inverted cups and open tubes must be used ; if not, then injecting valves should be employed as easiest to work. In the former case, if you impregnate at one side with the stop-cocks open, you will cause the fermenting fluid or liquid to circulate through the tubes of the other side ; hence this sort of vessel forms a commodious impregnator for impregnating the worts and the

 vinegar,

vinegar, with all or any of the gases, either separately or together; and by forcing the contained fluid to circulate, more effectually promote the impregnation by bringing every particle of the liquid mass in contact with the elastic fluids, and by their mutual motion and re-action permanently combine into one homogenous mass; this definition of a process the most curious among the operations of nature, is equally applicable to beer, ale, wine, &c.

The *Nascent State* in which these combinations take place during fermentation, if the *intestine motion* and *ebullition* with which it is accompanied may be called so, is the only state which it is thought we are at present capable of procuring them in, except the effervescence of chemical affinities with which they are performed; and these combinations and the consequent changes produced, when unaccompanied with visible ebullition or effervescence, are said to take place in a *nascent or quiescent state.*

Every one concerned in fermentation is more or less acquainted with the properties of ferments, so far as relates to their effects, and frequently without considering the nature and composition of their parts. Yeast contains about one part of hydrogen, three of carbon, and eight of oxygen.

Attenuation is the result of a due resolution of the fermentable matter produced by excited fermentation, which divides mucilage, resolves viscidities, and breaks down cohesions, extricates the emprisoned gases, generates heat and motion, and by frequent commixture promotes the operation of the component particles on each other, by exposing a fresh surface, and bringing them within the sphere of each others attraction.

The carbonic acid gas, or fixed air generated during the process, is by my apparatus arrested, and filtered of the fine ethereal spirit it

carries

carries off in its flight, and formerly dissipated in the atmosphere, which is now saved, and the redundant fixed air by the intermedium of oxygen united to part of the hydrogen of the water, or of the fermentable matter of the fluid, or redundant hydrogen, supplied by other means, hereafter explained, and accommodated to the nature of the case, and the aptness of the existing affinities.

As their original attraction is weakened by heat and motion, their expansion is increased by repulsion; and as they *evolve* and recede from each other in this way, they are fitted by the change in their modification to *involve* each other, and form new attractions, by presenting themselves to each other in a different form, and within the sphere of each other's affinity, under changes induced in their nature conducive to this end, brought about by the joint efforts of *air* and the operations of *nature*, but from not being fully known, cannot be exactly defined, though with much ease practically explained.

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* The Brewery standing high in the scale of the public revenue, the very humble rank which it obtains in the circle of the sciences is the more to be regretted, and ought to be a spur to the ambition of its professors to raise it into the important notice it merits, that it may no longer be the rough rock upon which government builds the bulk of her finance, but become the finished column of the edifice, so that the supported and the supporter may be contemplated with equal admiration.

That this cannot be done without the serious efforts of individuals to shake off habitual errors, and emerge from the professional obscurity

* Richardson.

rity of their ancestors, may be inferred from the volume here presented to the public; but to set the matter of general improvement in a still less problematical light, and at the same time to intimate, that there are qualities resident in the materials for brewing which are only obtainable by a scientific intimacy with the subject, it may not be improper to take a cursory view of the *practice of the brewhouse,* in such parts as may best tend to that purpose.

It were, perhaps, of no importance to intimate to the brewer, the requisite *qualities of the materials* themselves. These being objects of his choice, rather than the produce of his skill, it may suffice that he be able to view them with a discriminating eye, in order to select such as possess the particular qualities necessary to particular purposes, and to vary them according to the intended characteristics of his liquor, or the several occasions of his practice.

The whole process of brewing, from the entire state of the materials to the final recomposition of their extracts, may be divided into three sections; omitting to particularize the preparation of the *grist,* though its extreme simplicity has not been able to guard it against popular prejudice, which has been found so prevalent, that, to answer a purpose which no one has yet satisfactorily explained, a demonstrable loss, to a very considerable amount, is the certain consequence to those who adopt it, when a moment's reflection, and an easy experiment, would convince them of its inconsistency.

I. TAKING THE LIQUOR.

In this preliminary part of the process, the skill of the brewer is very much to be exerted, as various malts require various degrees of heat for the more advantageous extraction of their valuable parts, and the greater perfection of the product; to determine on which, will materially

materially rest in the judgment of the operator. Here it is to be observed too, that the *first liquor* inevitably stamps a characteristical impression on the whole gyle; and as the complexion of the future product must receive a powerful tincture from this leading principle, so an error once committed in its application, will ever leave traces of its influence, in spight of the efforts of the most judicious operator. Whence it is evident, how much the *use of the thermometer* ought to be studied by the brewer, in order to insure him that certainty of success which he can by no dissimilar means obtain. Without this instrument, it is impossible he can accommodate his practice to the different qualities of his malts, so as to secure to himself every obtainable advantage. The discrimination of the senses is limited and irregular. Beyond the temperature of the body our judgment of heat cannot reach, and within that degree it is very incompetent. In this business, the variation of a very few degrees, which the instrument only can determine, produces effects not less extraordinary in themselves, than important to the interest of the brewer. It is here the foundation is laid of that desirable quality, *transparency*, which, by a proper regulation of heat, according to the quality of the malt, may be procured in a few days, or postponed to as many weeks or months, agreeable to the convenience of the brewer, or the taste of the consumer.

From these considerations may be inferred the vexatious consequences which often result from wrong practice herein; and it is a demonstrable truth, that many disgraceful properties of beers have here their origin, which being attributed to other causes, the operator is induced to persist in errors, which ever lead to disappointment and loss.

II. BOILING

II. BOILING OF WORTS.

To a person unacquainted with the brewing business, it would appear almost incredible, that an operation so simple as this should have occasioned such a diversity of opinion amongst the practical brewers. Some contend for a *short*, others for a *long time*, and there are those who observe *no time at all*, being guided by certain criterions to judge of the proper period when to *strike* their worts. These, agreeable to their several intentions, may be all right; on the contrary, they may be all wrong. A particular attention to their several uses may be advantageous, though a general adoption of either must be prejudicial. According to the qualities the intended gyle is to possess, should this operation be varied. To some beers the *criterion* is essential, to others *time* is indispensable; nor are the distinguishing qualities of the most celebrated malt-liquors to be obtained and preserved, without the strictest attention to this particular; whence it will not appear at all extraordinary, that the copper often receives a good extract, and turns out a bad wort.

III. FERMENTATION.

Of all the parts of the brewing process, this is at once the most difficult to conduct, the most subject to error, and the most important to the interest of the brewer. The *preservative quality*, the *distinguishing flavour*, the *body*, and *spirituosity*, are here to receive their actual existence. Here, again, the *thermometer* must be the grand clew to direct the artist, securely and with certainty, to the several interesting windings of this subtile and perplexing labyrinth, without which he is in the utmost danger of being perpetually bewildered, if not absolutely lost. *Chance*, it is true, may sometimes direct him right; but he must be a very ignorant traveller who would trust his

safety,

safety, in a dangerous and intricate road, to the fortuitous conduct of so blind a guide, when he can put himself under the guidance of a safe and experienced conductor. The success of the brewer, in this article of his process, will ever be precarious, without a knowledge of the use of the thermometer, in its newly-discovered mode of application, by which the accidents to which fermentation is extremely liable, and which the nicest perception of the senses cannot frequently discover, are immediately detected. Whence it may, with great justice, be termed the *index* of this extraordinary operation, which at all times points out the several periods of its progress, and without which the operator must ever be as uncertain of truth, as he who judges of the time of day by a watch deprived of its hour-hand.

To particularize the several important properties finally resulting from a judicious management of fermentation, it may be necessary to advert to those qualities above cited, as actually existing in, or ultimately derived from it.

First, the *preservative quality* has but a partial residence in fermentation. Hops, undoubtedly, furnish the *preservative* of beers; but they can only be considered as supplying the semina of that quality, which, by their extraction in the boiling worts, may be said to be sown, whilst the active powers of a perfect fermentation are, alone, the genial shower and vivifying ray which quicken and mature the expected product. Several known instances speak in confirmation of this, where beers have had a sufficient quantity of this vegetable to have preserved them sound for two years, and have notwithstanding come *forward* in two months; and that it results from an ill-conducted fermentation only, is further evinced by the observation, that such beers are always *stale* and *bitter* at the same time, arising from an imperfect union and recomposition of the several parts of the extracts, which is the peculiar business of fermentation to accomplish,

in

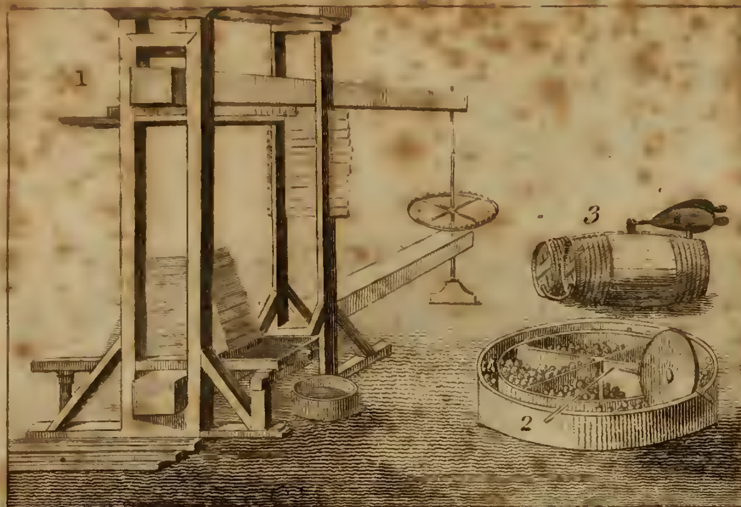
in the utmost perfection, under such regulations and restrictions as lie beyond the vague process of the random practitioner, and the ill-founded hypothesis of the mere speculatist.

Secondly, the *distinguishing flavour* of malt-liquors is, also, materially resident in this interesting part of the process. The liquor here assumes various flavors, according to the force of, and time of continuance under the action. It is here in actual *embryo,* and, like heated wax, ready to receive the minutest foreign impression; whence we are cautioned against accidents which might prove injurious, and are led to attempt the improvement of natural flavours. Thus, by a proper regulation and conduct of fermentation, the most pleasing genuine flavors are naturally, as well as some others, by certain adventitious means, obtainable, to any desired degree of perfection.

Thirdly, by the *body* of beers is not to be understood the *strength,* but the consistence, the materiality, if it may be so termed, which is distinguished by the palate into *light, heavy, thin, full, soft, smart,* either of which it is eminently in the power of fermentation to supply, as far as is consistent with the real strength and goodness of the wort. These desirable ends are of the greater import, since *the gratification of the palate* is the first object of the brewer's attention, because it is the first inducement to the disposal of his liquor; *strength* being but a secondary consideration in the estimation of malt-liquors, the goodness of which is ever marked by those great essentials of a saleable commodity, *flavor* and *transparency,* as qualities less easily obtained than *potency*; for it may be in the power of a person to make *strong* beer, when it shall baffle the utmost exertion of his art to make it *pleasant.*

Fourthly, spirituosity, both in its origin and existence, as it relates to the foregoing article, may be termed the *vital principle* of malt-liquors, whence they acquire the power of invigorating the body, and exhilarating

Pl. 8.



1 A Press for Wine, Cider or Fruit, 2, an Apple Mill, 3 A Forcing Bellows.

4 A Wine Press, 5 A Mashing Machine, 6 A Pneumatic Bellows &c.

Cider Mill.

Cider Press.

exhilarating the mind. The mere extracts of the materials, either severally or in combination, exhibit no signs of this principle, till the reciprocal action of their parts, in fermentation, calls it into life. It is well known that *must* * produces no spirit in distillation, and every brewer can tell, that the strongest *raw wort* would have no inebriating effect on the drinker. Nor is this to be accounted for, by the supposition that certain parts of the *must* act on the body as a corrector of the inebriating quality, but by the absolute non-existence of spirituosity, previous to fermentation; for the recommixture of the whole component parts of the wort, after their separation, &c. by this action, rather increases than diminishes its intoxicating power; thence intimating, that fermentation does not *set at liberty*, but positively *creates*, the spirituous parts of the liquor.

This, then, is the grand field where the artist is to reap the chief harvest of his labors. If fermentation, as is evident, be the only part of the process which realizes the potency of malt-liquors, it must thence occur to the most ordinary capacity, that every error in this complicated business, is a real loss of strength to the beer, and a consequential diminution of the brewer's profits; on the contrary, every new advantage obtained therefrom, is an additional emolument, without increasing the price or diminishing the quality of his liquor. It is not, however, to be hence understood, that *length of time* constitutes perfection in this action, notwithstanding the prevailing opinion, on this subject, which has a strong tendency thereto. Fermentation carried beyond a certain period, defeats its own purposes, by proceeding to undo all that it has before done. This period is, when the operation is arrived at such a height as to require the immediate *cleansing* of the liquor into casks, a crisis to which no formal rules can positively direct, it sometimes happening in the space of one day, sometimes not till the expiration of many, ever varying according to

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* Unfermented extracts of fermentable subjects.

the strength, the heat, the quantity, and even local situation of the fermenting liquor; and this crisis has so delicate a relation to the quality of the subject, that, in some particular processes, to anticipate, or exceed it, but a very few hours, would prove destructive to the gyle. To avoid both extremes, with certainty and precision, requires a very clear insight into this perplexing business; a difficulty which is now rendered entirely familiar, by the assistance of the thermometer, which not only discovers an imperfect from a perfect fermentation, but, with certain concomitant appearances, distinguishable by the perception of the senses, points out the proper period of *cleansing* to infallible nicety; at which period, alone, is to be expected that regular *purgation* in the casks, which equally avoids the *violence* tending to acidity, and the *languor* that produces the most disagreeable vapidity, heaviness, ill flavour, and a train of other evils which do not immediately discover themselves.

From the foregoing few strictures, it is easy to conceive, what a number of advantages accrue to a proficient in the art, from well-conducted processes; and how many valuable qualities are lost to the unskilful professor, from the want of a knowledge of *the component parts of the materials, the proper modes of extracting their virtues, the purposes of their combination, and the action and result of their combined powers.* Possessed of this knowledge, the operator is enabled to accommodate, with every appearance of success, the various palates of the consumers, with equal advantage and reputation. If a *mild, sparkling liquor* be preferred, he can produce spontaneous pellucidity, and every principle of perfection, in a few weeks; if *soft, full* beer be required, he knows how to effect this, without adding to his grist, as well as he can give *lightness* and *vinosity,* without diminishing the strength of his liquor. To this knowledge also he is indebted for an effectual security against those bugbears of the ignorant operator, *cloudiness, violent fretting, flatness,* &c. &c. whilst it produces an unsolicited extension of trade, with superior liquor, and superior emolument.

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To remedy the disappointments and losses resulting from bad practice, and to render this important business of more general utility to the public, and more particular advantage to individuals, is the purpose of the author, who, by a continued application to the subject, during several years practice and experience, has had the happiness to reduce the brewing science to a plain system, confirmed throughout by the most successful events. His *theory* is not a chimera of the brain, nor his *practice* the child of hypothesis. By a studious attention to a long course of repeated experiments, in the production of every variety of malt-liquor, the *former* is discovered, which again, with reflected light, illumines the *latter*; so that by mutual reflection both are established and confirmed to a degree of certainty equal to the utmost wishes of the operator.

It is hoped the reader will find at least a partial confirmation of this in the subsequent sheets, now first published in a collected form; and that he will do the author the justice to believe, that the particulars of his system, which, for obvious reasons, he withholds from the eye of the public, are not less founded in philosophical investigation, nor less worthy the attention of the enquiring artist.

OF WATER.

The general distinction of water, as it respects the common purposes of life, extends no further than the simple terms of *hard* and *soft;* and though it may not be in the power of every brewer to pursue his inclination in the choice of them, yet as there are some who can benefit of the distinction, by the possession of both, and as all

all may profit by the judicious application of either, it may not be amiss to say somewhat by way of discriminating their virtues, and pointing out their uses in brewing.

Hard water is that, which, being strongly impregnated with certain terrestrial matters, does not easily lather with soap, but causes it to curdle or coagulate, and is in general less fit for culinary purposes. Its specific gravity is greater than that of soft water, whence its power as a menstruum is proportionably lessened; but the experienced brewer, in some measure, guards against this inconvenience, by exposing his water, as much as he can, to the softening virtue of the air, and by varying the extracting heat, which in hard water produces effects at a certain degree, similar to those producible only at a distant degree in soft. This, however, has only relation to one species of malt-liquor; for, with respect to the rest, the practice is unnecessary, if not prejudicial to the production of very desirable qualities.

In fermentation we find a considerable difference in the use of hard water, which does not at first so readily incline to that action, but it occasions a more violent, though less durable, operation than soft. As a preservative it may be preferred, on account of its containing some alkaline qualities, which contribute to counteract any tendency to acidity in the beer, and thence assist in its preservation. Transparency is also more easily obtainable by the use of hard water; first, from its inaptitude to extract such an abundance of that light mucilaginous matter, which, floating in the beer, for a long time occasions its turbidity; secondly, from its greater tendency to a state of quietude, after the vinous fermentation is finished, by which those floating particles are more at liberty to subside; and lastly, from the mutual aggregation of the earthy particles of the water with those of the materials, which, by their greater specific gravity, thus aggregated, not only precipitate themselves, but carry down also that lighter mucilage just mentioned. For these reasons it is not well

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adapted to the brewing of porter, and such beers as require a fullness of palate, when drawn to the great lengths of the London brewery, and some country situations. But we can, by a judicious application of the extracting heat, and a peculiar mode of conducting the action of fermentation, produce from hard water, as far as Art can be the substitute of Nature, those qualities which, by unvaried practice, are only obtainable from soft.

By *soft water* we mean that which, being unburthened with the rigid earths, is of less specific gravity, of more simple taste, and of greater purity, which renders it more capable of entering the pores, and forming a solution of such parts of the materials as yield to the impression of the simple element.

The purity of water is determined by its lightness, and in this distilled water only can claim any material degree of perfection. Rain water is the purest of all, naturally produced; but by the perpetual exhalation of vegetables, and other fine substances floating in the atmosphere, it does not come down to us entirely free of those qualities which pond and river waters possess in a greater degree. These, especially of rivers running through fens and morasses, from the quantity of grass and weeds growing therein, imbibe an abundance of vegetable solutions, which occasions them to contain more fermentable matter, and consequently to yield a greater portion of spirit, but at the same time induces such a tendency to acidity as will not easily be conquered. This is more to be apprehended towards the latter end of the summer, than at any other season of the year; because these vegetable substances are then in a state of decay, and thence more readily impart their pernicious qualities to the water which passes over them.

At such an unfavorable time should the brewer be necessitated to pursue his practice, it will behove him to pay the utmost attention to

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the cause of this disposition in his liquor, and thence endeavor to prevent the ill consequences, by conducting his process to the extraction and combination of such parts of the materials, as his judgment informs him will best counteract its effects.

When there is the liberty of choice, I should recommend the use of that water which, from natural purity, equally free of the austerity of imbibed earths, and the rankness of vegetable saturation, has a soft fulness upon the palate, is totally flavorless, inodorous, and colourless, whence it is the better prepared for the reception and retention of such qualities as the process of brewing is to communicate and preserve.

OF MALT.

The end of the process of malting is well known, to every one concerned in the making and consumption of malt, to be the production of that *saccharum*, upon which its value so eminently depends; but in the means of accomplishing it, they are not so entirely agreed. In dry barley we find no appearance of this quality; the first efforts of vegetation discover none; let them continue a little longer, and we perceive its gradual production to a certain period; beyond that period it again begins to disappear, and is soon totally lost.

To investigate the causes of these extraordinary changes were fruitless enquiry. Philosophy may amuse itself in tracing the imaginary gradation, till it be lost with the principle it pursues. The man of business will here find a better account in noting effects, than in

in attempting to discover causes, which in the productions of nature will ever be hypothetical, till art can make the copy like the original.

In the business of malting, similar effects, in different subjects, are not produced at the same time, nor in the same apparent state of the grain, but vary according to their several natures and qualities. Thus, Indian corn, and all the larger bodied grain, is found to require a length of time sufficient to shoot out a considerable acrospire, before the production of its saccharine matter is perfect, whilst that of barley would be entirely destroyed by the same practice.

The process of making malt is an artificial, or forced, vegetation, in which, the nearer we approach the footsteps of nature in her ordinary progress, the more certainly shall we arrive at that perfection of which the subject is capable. The farmer prefers a dry season to sow his corn in, that the common moisture of the earth may but gently insinuate itself into the pores of the grain, and thence gradually dispose it for the reception of the future shower, and the action of vegetation. The maltster cannot proceed by such slow degrees, but makes an immersion in water a substitute for the moisture of the earth, where a few hours infusion is equal to many days employed in the ordinary course of vegetation; and the corn is accordingly removed as soon as it appears fully saturated, lest a solution, and consequently a destruction, of some of its parts, should be the effect of a longer continuance in water, instead of that separation which is begun by this introduction of aqueous particles into the body of the grain.

Were it to be spread thin after this removal, it would become dry, and no vegetation would ensue; but being thrown into the couch, a kind of vegetative fermentation commences, which generates heat, and produces the first appearance of germination. This state of the

barley is nearly the same with that of many days continuance in the earth, after sowing, but being in so large a body, it requires occasionally to be turned over and spread thinner; the former to give the outward parts of the heap their share of the acquired warmth and moisture, both of which are lessened by exposure to the air; the latter to prevent the progress of the vegetative to the putrefactive fermentation, which would be the consequence of suffering it to proceed beyond a certain degree.

To supply the moisture thus continually decreasing by evaporation and consumption, an occasional, but sparing, sprinkling of water should be given to the floor, to recruit the languishing powers of vegetation, and imitate the shower upon the corn field. But this should not be too often repeated; for as in the field too much rain and too little sun produce rank stems and thin ears, so here would too much water, and of course too little dry warmth, accelerate the growth of the malt, so as to occasion the extraction and loss of such of its valuable parts, as, by a slower process, would have been duly separated and left behind.

By the slow mode of conducting vegetation here recommended, an actual and minute separation of the parts takes place. The germination of the radicles and acrospire carries off the cohesive properties of the barley, thereby contributing to the preparation of the saccharine matter, which it has no tendency to extract, or otherwise injure, but to increase and meliorate; so long as the acrospire is confined within the husk; and by as much as it is wanting of the end of the grain, by so much does the malt fall short of perfection, and in proportion as it has advanced beyond, is that purpose defeated.

This is very evident to the most common observation, on examining a kernel of malt, in the different stages of its progress. When the acrospire has shot but half the length of the grain, the lower part, only,

only, is converted into that mellow saccharine flour we are solicitous of, whilst the other half exhibits no other signs of it, than the whole kernel did at its first germination. Let it advance to two-thirds of the length, and the lower end will not only have increased its saccharine flavour, but will have proportionally extended its bulk, so as to have left only a third part unmalted. This, or even less than this, is contended for by many maltsters, as a sufficient advance of the acrospire, which they say has done its business as soon as it has passed the middle of the kernel. But we need seek no further for their conviction of error, than the examination here alluded to.

Let the kernel be slit down the middle and tasted at either end, whilst green; or, let the effects of mastication be tried, when it is dried off; when the former will be found to exhibit the appearances just mentioned, the latter to discover the unwrought parts of the grain, in a body of stony hardness, which has no other effect in the mash-tun than that of imbibing a large portion of the liquor, and contributing to the retention of those saccharine parts of the malt which are in contact with it; * whence it is a rational inference, that three bushels of malt, imperfect in this proportion, are but equal to two of that which is carried to its utmost perfection. By this is meant the farthest advance of the acrospire, when it is just bursting from its confinement, before it has effected its enlargement. The kernel is then uniform in its internal appearance, and of a rich sweetness in flavour, equal to any thing we can conceive obtainable from imperfect vegetation. If the acrospire be suffered to proceed, the mealy substance melts into a liquid sweet, which soon passes into the blade, and leaves the husk entirely exhausted.

The sweet thus produced by the infant efforts of vegetation, and lost by its more powerful action, revives and makes a second

* As is generally believed.

appearance in the stem, but is then too much dispersed and altered in its form, to answer any of the known purposes of art.

The periods of its perfect appearance are, in both cases, remarkably critical. It is at first perfect at the instant the kernel is going to send forth the acrospire, and form itself into the future blade; it is again discovered perfect when the ear is laboring at its extrication, and hastening the production of the yet-unformed kernels. In this does it appear the medium principle of nature's chemistry, equally employed by her in her mutation of the kernel into the blade, and her formation thence of other kernels, by which she effects the completion of that circle to which the operations of the vegetable world are limited.

Were we to inquire, by what means the same barley, with the same treatment, produces unequal portions of the saccharine matter, in different situations, we should perhaps find it principally owing to the different qualities of the water used in malting. Hard water is very unfit for every purpose of vegetation, and soft will vary its effects according to the predominating quality of its impregnations. Pure elementary water is in itself supposed to be only the vehicle of the nutriment of plants, entering at the capillary tubes of the roots, rising into the body, and here depositing its acquired virtues, perspiring by innumerable fine pores at the surface, and thence evaporating, by the purest distillation, into the open atmosphere, where it begins anew its round of collecting fresh properties, in order to its preparation for fresh service.

This theory leads us to the consideration of an attempt to increase the natural quantity of the saccharum of malt by adventitious means; but it must be observed, on this occasion, that no addition to water will rise into the vessels of plants, but such as will pass the filter; the pores of which appearing somewhat similar to the fine strainers or absorbing vessels employed by nature in her nicer operations, we by analogy

analogy conclude, that properties so intimately blended with water as to pass the one, will enter and unite with the economy of the other, and *vice versa*.

Supposing the malt to have attained its utmost perfection, according to the criterion here inculcated, to prevent its farther progress, and secure it in that state, we are to call in the assistance of a heat sufficient to destroy the action of vegetation, by evaporating every particle of water, and thence leaving it in a state of preservation fit for the present or future purpose of the brewer.

Thus having all its moisture extracted, and being, by the previous process, deprived of its cohesive property, the body of the grain is left a mere lump of flour, so easily divisible, that the husk being taken off, a mark may be made with the kernel, as with a piece of soft chalk. The extractible qualities of this flour are, a saccharum, closely united with a large quantity of the farinaceous mucilage peculiar to bread corn, and a small portion of oil, enveloped by a fine earthy substance, the whole readily yielding to the impression of water, applied at different times and different degrees of heat, and each part predominating in proportion to the time and manner of its application.

In the *curing* of malt, as nothing more is requisite than a total extrication of every aqueous particle, if we had, in the season proper for malting, a solar heat sufficient to produce perfect dryness, it were practicable to produce beers nearly colourless; but that being wanting, and the force of custom having made it necessary to give our beers various tinctures and qualities resulting from fire, for the accommodation of various tastes, we are necessitated to apply such heats in the drying as shall not only answer the purpose of preservation, but give the complexion and property required.

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To effect this, with certainty and precision, the introduction of the thermometer is necessary; but the real advantages of its application are only to be known from experiment, on account of the different construction of different kilns, the irregularity of the heat in different parts of the same kiln, the depth of the malt, the distance of the bulb of the thermometer from the floor, &c. &c.; for though similar heats will produce similar effects in the same situation, yet is the dispersion of heat in every kiln so irregular, that the medium spot must be found for the local situation of the thermometer, ere a standard can be fixed for ascertaining effects upon the whole. That done, the several degrees, necessary for the purposes of porter, amber, pale beers, &c. are easily discovered to the utmost exactness, and become the certain rule of future practice.

Though custom has laid this arbitrary injunction of variety in our malt-liquors, it may not be amiss to intimate the losses we often sustain, and the inconveniences we combat, in our obedience to her mandates.

The further we pursue the deeper tints of colour, by an increase of heat beyond that which simple preservation requires, the more we injure the valuable qualities of the malt. It is well known, that scorched oils turn black, and that calcined sugar assumes the same complexion. Similar effects are producible in malts, in proportion to the increase of heat, or the time of their continuing exposed to it. The parts of the whole being so mutually united by nature, an injury cannot be done to the one without affecting the other; accordingly we find, that such part of the subject as might have been severally extracted, for the purposes of a more intimate union by fermentation, are, by great heat in curing, burnt and blended so effectually together, that all discrimination is lost, the unfermentable are extracted with the fermentable, the integrant with the constituent, to the very great loss both of spirituosity and transparency. In paler malts, the ex-

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tracting liquor produces a separation which cannot be effected in brown, where the parts are so incorporated, that, unless the brewer is very well acquainted with their several qualities and attachments, he will bring over, with the burnt mixture of saccharine and mucilaginous principles, such an abundance of the scorched oils, as no fermentation can attenuate, no precipitants remove; for, being in themselves impediments to the action of fermentation, they lessen its efficacy; and, being of the same specific gravity with the beer, they remain suspended in, and incorporated with, the body of it,—an offence to the eye, and a nausea to the palate, to the latest period.

From this account it is evident, that the drying of malt is an article of the utmost consequence. Concerning the proper degree of heat to be employed for this purpose, M. Combrune has related some experiments made in an earthen pan, of about two feet diameter, and three inches deep, in which was put as much of the palest malts, very unequally grown, as filled it on a level to the brim. This being placed over a little charcoal in a small stove, and kept continually stirred from bottom to top, exhibited different changes according to the degree of heat employed. On the whole he concludes, that true germinated malts are charred in heats between one hundred and seventy-five and one hundred and eighty degrees; and that, as these correspond to the degrees in which pure alcohol, or the finest spirit of the grain itself, boils, or disengages itself therefrom, they may point out to us the reason of barley being the fitest grain for the purposes of brewing.

From these experiments, M. Combrune has constructed a table of the different degrees of the dryness of malt, with the colour occasioned by the difference of heat. Thus malt exposed to one hundred and nineteen degrees, is white; to one hundred and twenty-four, cream colour; one hundred and twenty-nine, light yellow; one hundred and thirty-four, amber colour; one hundred and thirty-eight, high

high amber; one hundred and forty-three, pale brown; one hundred and forty-eight, brown; one hundred and fifty-two, high brown; one hundred and fifty-seven, brown inclining to black; one hundred and sixty-two, high brown speckled with black; one hundred and sixty-seven, blackish brown with black specks; one hundred and seventy-one, colour of burnt coffee; one hundred and seventy-six, black. This account not only shews us how to judge of the dryness of malt from its colour, but also, when a grist is composed of several sorts of malt, what effect the whole will have when blended together by extraction. Experience proves, that the less heat we employ in drying of malt, the shorter time will be required before the beer which is brewed from it is fit to drink; and this will be according to the following table:

124 deg.	1	month.	138 deg.	6	months.	152 deg.	15	months.
129 deg.	3	months.	143 deg.	6	months.	157 deg.	20	months.
134 deg.	4	months.	148 deg.	10	months.	162 deg.	22	months.

OF HOPS.

The chemical principles of vegetables, as far as art has yet been able to discover by analysis, are *water, salt, oil,* and *earth.* These, in different vegetables, do not only abound in different proportions, but vary in their species and properties. The water, being only the general medium of the whole, is the same simple element in all; the oil in some plants is more thin and fluid, in others, more gross and viscous; the salt is in some more volatile, in others, more fixed; in some acid, in others, alkaline; the earth appears to be the mere un-characteristic

characteristic residuum of the whole, to which all have relation, and to which all finally return.

In Hops, the quantity of oil is abundant; the finer part of an agreeable fragrance and great volatility; the coarser, from its intimate union with an austere saline earth, of the alkaline kind, is grosser in its odour, harsher in its flavour, and less subject to avolation.

The time of picking, the mode of curing, the care in bagging, the place of keeping, all have their share in the preservation or destruction of the finer qualities of this vegetable. If the hop be plucked too early, the consequence of immaturity is obvious; if it hang too late, the constant avolation of its fine unctuous parts, wastes its fragrance, destroys its colour, and renders it of less value and efficacy. An application of too much heat in the curing has similar effects; for by evaporating the aqueous parts of the vegetable too hastily, the finer parts of the essential oil rise with them and are lost, whilst the remainder receives an injury somewhat similar to that of malt by the like injudicious treatment. The care in bagging and keeping is equally important, on the same principle of excluding, as much as possible, the action of the external air upon the hop, which carries off its more valuable qualities in the same manner as by a too long continuance on the plant. The closer they are pressed down in the bag, the more effectual is their security against this injury; and the best practical method of keeping them is in a close, but dry, room, the bags laid upon each other, and the interstices well filled with a dry inodorous matter, such as the first screenings of malt, &c.

Time, however, will impair their virtues, in spite of the utmost precaution, and that so rapidly, as to render them incompetent to the nicer purposes of the pale ale brewer, after the expiration of the first year, in all the ordinary modes of preserving them.

In these virtues of the hop are we to look for the primary principles of flavour and preservation of malt-liquors, which are to be extracted in such manner and proportion, as to the judgment of the brewer shall seem most likely to answer those intentions. To accomplish this, with certainty and advantage, particular attention must be had to the several ends of extracting, and the different effects of those extracts upon the rest of the process, viz. whether the purpose of flavour will not defeat that of preservation, and whether the too anxious pursuit of preservation will not weaken the powers, and lessen the effect of fermentation, to the very great loss of the subject; for it is very certain, that every unctuous principle is an enemy to fermentation, and has a direct tendency to impair its action and destroy is efficacy. *

Hence are we taught by reason, what is confirmed by experience, that the soluble parts of the hop, extracted severally, answer several different purposes in beers, but taken collectively, tend to confound their virtues and pervert their uses; and that in their extraction, if the means be not nicely proportioned to the end, the order of the process is destroyed, and the intention of the brewer defeated. †

OF

* It is to be hoped this will be a lesson to those who are so covetous as to commit the spent hops to the press, in order to extract every particle of the gross nauseous bitter.

† The Hop is a bitter aromatic vine, exhibiting a sensible acrimony to the taste, and endued with an austerity, or roughness; this last quality is discovered only by close observation, when it evidently manifests itself; if the hops are boiled for some considerable time in fair water, they will give out a harsh roughness, almost bordering on the austere astringency of *alum*. The aromatic part of the hop, as I have frequently experienced, rises in distillation, and comes over in a whitish oily fluid, fragrant to the sense of smelling. The much admired *preservative, grateful bitter*, is of a mild agreeable flavour, semivolatile, yet requiring more fire to extract it, than the aromatic part, though much less than the austere astringent part.

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OF WORTS.

Having taken a cursory view of the materials themselves, we come now to consider more particularly the several modes of applying them, in order to extract their valuable parts, and the different effects of their application, in forming such extracts.

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What I here assert is the result of many experiments, frequently repeated. I always found, that the aromatic flavour of the hop was extracted by the gentle heat of *infusion* in warm water, that upon a quarter of an hour's boiling, the pleasant bitterness, and the agreeable part of the astringency came next, and when the boiling was continued about an hour, the nauseous, austere, acrimonious, roughness, became perceptible, and shewed itself more and more, as the boiling continued, while the aromatic grateful parts, after boiling an hour, began to be volatalized, and were soon after evaporated and lost, till at length nothing but a mere bitter, like that of *quassia*, but much more nauseous, was all that was left.

Hence, though those several qualities reside together in the hop, they are capable of being separated, and the aromatic flavour, and grateful, mild, astringent, bitter may be extracted alone, without the austere nauseous one.

To obtain this desirable end should be the brewer's aim; and this is only to be done by boiling the worts much less than they hitherto have been.

Long boiling, so injurious to the *hop*, is not less prejudicial to the *worts*, whose fragrant principle being volatile, is dissipated by long boiling also. It is this volatile principle of the malt and hops that contributes most largely to the excellence of the best *ale* and *beer*, and is very distinguishable by its mild and grateful fragrance. Who has not smelt this volatile principle of the malt when mashing, and much more so at a distance from the brewhouse when the hop worts are boiling in an open copper, rendered still more agreeable by the volatile principle of the hops; indubitably they are an irreparable loss, which is now likely to be more guarded against, since I first disseminated my notions of these things among the trade, insomuch, that many of them have either enclosed their old, or got new close coppers, and some, close mash tuns, of the advantages of which they are every day more sensible; and, after what has been said, too obvious to be mistaken.

We have already seen that barley, by a partial vegetation, stopped at a certain period, is converted into *malt*, a friable substance, easily reducible to a mellow flour, the soluble principles of which are, a saccharum, very distinguishable by the senses, intimately united with a mealy, mucilaginous matter, and a small portion of oil enveloped by an earth.

The quality of the saccharine part resembles that of common sugar, to which it is practicable to reduce it, and its characteristical properties are entirely owing to its intimate connection with the other parts of the malt, from which such distinguishing flavours of beers are derived, as are not the immediate result of the hop. Were it not for these properties, the brewer might adopt the use of sugar, molasses, honey, or the sweet of any vegetable, to equal advantage, which cannot now be done, unless an eligible succedaneum be found to answer that purpose. As we are at present circumstanced, a search on the other side would turn more to the brewer's account. We have in malt a superabundance of the grosser principles, and would government permit the introduction of a foreign addition to the saccharine, which is too deficient, many valuable improvements might be made from it; as we could, by a judicious application of such adventitious principle, produce a second and third wort, of quality very little inferior to the first.

But in these experiments, a very particular attention would be necessary to the solvent powers of the water at different degrees of heat, and to the enquiry, how far a menstruum already saturated with one principle, may be capable of dissolving another? Such a consideration is the more necessary on this occasion, to direct us clear of two extremes, equally disagreeable; the first is, that of applying the menstruum pure, and at such a heat as to bring off an over proportion of the oleaginous and earthy principles, which would occasion in the beer, thus wanting its share of natural saccharum, a harshness and austerity,

austerity, which scarce any time the brewer could allow would be able to dissipate; the other is, that of previously loading the menstruum with the adopted sweet, in such an abundance, as to destroy its solvent force upon the characteristical qualities we wish to unite with it, and thereby leave it a mere solution of sugar. The requisite mean is that of considering, what portion of the saccharine quality has been extracted in the first wort, according to the quantity of water and degree of heat applied, and then to make such a previous addition of artificial sweet as will just serve to counterbalance the deficiency, and assimilate with that portion of the remaining principles we are taught to expect will be extracted with the succeeding wort.

From the nature of the constituent principles of malt, it is easy to conceive that the former, or saccharine and mucilaginous parts, yield most readily to the impression of water, and that at so low a degree of heat, as would have no visible effect upon the latter. If, therefore, we are to have a certain proportion of every part, it is a rational inference, that the means of obtaining it rests in a judicious variation of the extracting heat, according to the several proportions required.

A low degree of heat, acting principally upon the saccharum, produces a wort replete with a rich, soft, sweet, fully impregnated with its attendant mucilage, and in quantity much exceeding that obtainable from increased heat; which, by its more powerful insinuation into the body of the malt, acting upon all the parts together, extracts a considerable portion of the oleaginous and earthy principles, but falls short in softness, fullness, sweetness, and quantity. This is occasioned by the coagulating property of the mucilage, which, partaking of the nature of flour, has a tendency to run into paste, in proportion to the increase of heat applied, by which means it not only locks up a considerable part of the saccharum contained therein, but retains with it a proportionate quantity of the extracting liquor,

which

which would otherwise have drawn out imprisoned sweet, thence lessening both the quantity and quality of the worts. And this has sometimes been known to have had so powerful an effect, as to have occasioned the *setting of the goods*, or the uniting the whole into a pasty mass; for though heat increases the solvent powers of water, in most instances, there are some in which it totally destroys them. Such is the presence of flour, which it converts into paste, besides those of blood, eggs, and some other animal substances, which it invariably tends to harden.

From a knowledge of these effects, we form our first ideas of the variations necessary in the heat of the extracting liquor, which are of more extensive utility than has been yet intimated, though exceedingly limited in their extent, from one extreme to the other.

The most common effects of too low a heat, besides sometimes producing immediate acidity, are an insipidity in the flavour of the beer, from a deficiency of those characteristical qualities before-mentioned; and a want of early transparency, from the super-abundance of mucilaginous matter, extracted by such heats, which, after the utmost efforts of fermentation, will leave the beer turbid, with such a cloud of its lighter feculencies, as will require the separation and precipitation of many months to disperse.

The contrary application, of too much heat, at the same time that it lessens the mucilage, has, as we have before seen, the effect of diminishing the saccharum also, whence that lean, thin quality observable in some beers; and by extracting an over proportion of the oleaginous and earthy principles, renders the business of fermentation difficult and precarious, and impresses an austerity on the flavour of the liquor, which will not easily be effaced.

Yet the true medium heat for each extract cannot be universally ascertained. An attention not only to the quality of the malt, but to the quantity wetted, is absolutely necessary to the obtaining every due advantage; nor must the period at which the beer is intended for use be omitted in the account. The quality of the water, also, claims a share in the consideration, in order to supply the want of solvent force in hard, and to allow for the natural lightness and fermentative quality of soft; a particular to which London, in a great measure, owes the peculiar mucilaginous and nutritious quality of its malt-liquors; though it is not an improbable conjecture, that the water of the *Seine*, and of some other large rivers on the continent, would produce similar qualities by similar application.

Although the variations above alluded to are indispensible, it is easy to conceive, from the small extent of the utmost variety, that they cannot be far distant; if therefore we know, that a certain degree extracts the first principles in a certain proportion, we need not much consideration to fix upon another degree that shall produce the required proportion of the remaining qualities, and effect that equal distribution of parts in the extract, which it is the business of fermentation to form into a consistent whole.

OF BOILING.

The principal use of this operation, as it respects the worts particularly, is to separate the grosser or more palpable parts of the extract, preparatory to that more minute separation which is to be effected in the gyle-tun. The eye is a very competent judge of this effect; for the coagulations or concretions into which the continued

action

action of boiling forms those parts, are obvious to the slightest inspection, whilst the perfect transparency of the interstices of the worts, points out its utility in promoting that desirable quality in the beer.

In pursuing this observation, we have the satisfaction to find the preceding theory of malt confirmed. The coagulating property of these parts, their superabundance in the first wort, especially from a low heat of liquor, the facility with which they form, and the superior bulk of the concretions in that wort, speak them to be parts of that farinaceous mucilage already explained; at the same time that the contrary appearances in the subsequent worts, their tardiness to concrete, and the very minute particles into which they form, in proportion to the abundance of the oleaginous quality extracted with them, evince the nature and existence of those other principles before described; for we find, by a common culinary practice, that an unctuous and an aqueous body may be so intimately united, by the interposition of flour, and the action of fire, as to become of a uniform consistence; which being then diffused in a large body of boiling water, the coagulation of the flour, or the separation of the whole, would with greater difficulty be produced, than if such union had not been.

With respect to the utility of decoction in extracting the virtues of the hop, it may be necessary to recur to the consideration of that vegetable, in order to form some idea of the time requisite to the several intentions of extraction.

The fine essential oil of hops being most volatile and soonest extracted, we are thence taught the advantage of boiling the first wort no longer than is sufficient to form the extract, without exposing it to the action of the fire so long as to dissipate the finer parts of this most valuable principle, and defeat the purpose of obtaining it. To the subsequent worts we can afford a larger allowance,

ance, and pursue the means of preservation so long as we can keep in view those of flavour, to which no rules can positively direct, the process varying with every variety of beer, and differing as essentially in the production of porter and that of pale ale, as the modes of producing wine and vinegar.

The consequence of not allowing a sufficient time for the due separation of the parts of the wort, and extraction of the requisite qualities of the hop, is obvious from what has been already said; should we proceed to the other extreme, we have every thing to apprehend, from the introduction of too large a portion of the grosser principles of the hop, which are very inimical to fermentation, and from impairing the fermentive quality of the worts themselves, by suffering their too long exposure to the action of the fire passing through them, whereby they are reduced to a more dense consistence, and their parts too intimately blended to yield to the separating force of fermentation, with that ease the perfection of the product requires.

OF FERMENTATION.

The general definition of fermentation is, *a spontaneous internal motion of constituent parts, which occasion a spontaneous separation and removal from their former order of combination, and a remarkable alteration in the subject, by a new arrangement and re-union.* This description is universal, and corresponds with the known effects of every species of the operation; but the particular kind to which our subject is limited, is the vegetable, which is again divided into the *vinous*, the *acetous*, and the *putrefactive*, forming a regular series or gradation, from the first origin of its action, to the total annihilation

of the subject; or, as Dr. Shaw expresses it, "The intention or tendency of Nature, is to proceed from the very beginning of vinous fermentation, directly, in one continued series, to putrefaction, and thence again to a new generation; which appears to be the grand circle, wherein all natural things are moved, and all the physical, or rather chemical, phænomena of the globe produced."

It is not, however, the business of the artist to preserve this circle, but to break the chain of connection in such parts as may best answer the ends of his pursuit. Thus, the brewer is to stop the progress of the operation at the *vinous*, whilst the vinegar-maker pursues it to the *acetous*, beyond which every purpose of art is defeated.

The result of vinous fermentation is the production of that inflammable spirit, which is no where to be found previous to this action, and in which principally the strength, or inebriating quality of beers consists. Hence it is evident, that in proportion as we conduct fermentation to that degree of perfection of which it is capable, we shall produce that desirable quality, and *vice versa*.

The only mode we are yet acquainted with, of proving the preference of this spirit, and determining the real strength of beers, is by distillation, which is not only the criterion of vinous fermentation, but the proof of its perfection or imperfection, by the quantity of spirit produced. By the same means is the acetous fermentation distinguished, which so alters, conceals, or destroys the inflammable spirit, that the still only throws over an acid, uninflammable, aqueous liquor; which seems to point out that regular progress to the annihilation of the whole, which putrefaction is to effect.

The principles produced by both these species of fermentation seem to be alike purely *ethereal;* for they are so exceedingly volatile as to be in perpetual avolation, by the common heat of the air only; but

but their effects upon the human body are as widely different as those of the operations which produce them. That which results from vinous fermentation, being by the heat of the stomach thrown up into the head, produces intoxication; whilst that from the acetous, by a similar evaporation, insensibly pervades the vessels of the head, and exsudes though the pores of the skin, with extreme subtilty, in a visible, but cold, perspiration. Thus are we taught to draw the line of discrimination in a series of causes, from a knowledge of effects only; or, in other words, to determine the nature of the fermentation, from the quality of the principle produced.

The immediate succession of the three species seems to be the consequence of continuing the subject in the same state; for vinous fermentation is no sooner completed, than the acetous commences, if the fermenting liquor be suffered to retain the same degree of heat; in which state being incapable of depositing its proper feculencies, their suspension and commotion in the body of the liquor, continue the action beyond the period of vinosity, and the acetous fermentation of necessity ensues; which, by a similar continuation and exposure to the external air, would immediately produce the putrefactive, and proceed to the completion of that circle, in which all the laboured combinations of Art resolve into the first simple principles of Nature.

To mark the limits of distinction, and stop the progressive force of fermentation, at such a period as shall best answer the brewer's purpose, in the production of every practicable degree of spirituosity; and to conduct the action to that period with every advantage to the subject, is a knowledge to be acquired not less from practical attention, than theoretical enquiries. It is my business here only to assist the latter; the former requires an elucidation somewhat beyond the bounds of verbal instruction.

In the doctrine of fermentation it is a maxim, that *such subjects as are most separable by means of water, air, and heat, have the greatest tendency to ferment;* accordingly we find, that wort, or the extract of malt, abounds in fermentable matter, but varies in quantity, in proportion to the heat and quantity of the liquor employed, agreeable to our theory of extracts. This fermentable matter we also find distinguished into saccharine, mucilaginous, oleaginous, and earthy. An adequate proportion of each of these principles is necessary to a regular fermentation, and the production of a perfect, uniform, beer. A surcharge of either, by destroying the equilibrium, changes the mode of the action, disturbs the due arrangement of the parts, and produces effects agreeable to the nature of the predominating principle. These effects, however, are not equally prejudicial to the beer; for we find that a surcharge of the saccharine and mucilaginous parts, though it occasions that turbidity and rawness of flavour before mentioned, is yet corrigible by time, and yields very readily to the action of precipitants; but an over-proportion of the oleaginous and earthy principles, besides the evils before enumerated, especially from the browner malts, is frequently productive of two of the most disagreeable qualities which ever disgraced the London brewery, where they have been particularly prevalent, and which time cannot correct, nor art effectually remove.

A due proportion of the fermentable principles being obtained, our next care is to collect the extracts into a body at such a degree of heat as will facilitate the action, and to apply such a portion of a proper ferment, as shall regulate and conduct it to the desired period of perfection.

It is well known that the juices, or extracts, of all saccharine vegetables, have a natural and spontaneous tendency to ferment into a vinous liquor; this is also the property of wort; but the effects are not similar. The expressed juices of fruits, the saccharine sap of certain

certain trees, &c. when collected into a body, at a due degree of heat, of themselves produce a wine, without the addition of a ferment; but worts, being loaded with an abundance of a tenacious mucilage, without yeast to assist and accelerate the efforts of nature, would run into an irregular and imperfect fermentation, or rather would immediately commence that *tumultuary motion* of their component parts, which is said to produce putrefaction. This is, in a great measure, confirmed by the effect; for though we find that the action has been so far vinous as to produce a small portion of inflammable spirit, yet the putrefactive has at the same time been so prevalent as to render the whole body of the liquid fœtid and nauseous in the extreme; a consequence often derived from suffering worts to remain too long, or in too large a body, without yeast, especially in warm weather, when they have a greater propensity to ferment in a body of a few inches deep, than they have in cold, at the depth of as many feet.

A proper application of yeast prevents this accident, and disposes the parts of the wort to that separation and new arrangement, on which the perfection of the product depends.

The quantity of fermentable matter, already in action, thus conveyed into the body of the wort, assists its spontaneous aptitude to ferment, and a violent struggle immediately ensues. The air contained in the yeast, being rarefied by the increased warmth it meets with in the wort, begins to break from its confinement, and escape at the surface, which is the first perceptible sign of fermentation. In the rapid progress of its particles towards the top, a smart attrition and collision are occasioned, between those particles, the body of the wort they pass through, and the grosser parts, which are, by their gravity, in contra-direction. By this attrition the oleaginous parts of the subject are separated, (a property which air is peculiarly allowed to possess) and, being more subtile and disposed to elasticity, would be carried off with the air, were they not too intimately connected with

and

and enveloped by the earthy, which are both too weighty to fly off, and too much inclined to collect and aggregate, by which means they at length, with the grosser mucilage, subside to the bottom, in the form of lees. But before this can be effected, by their adherence to the particles of air, to which they form a vehicle, they are rapidly carried to the surface, where the air bursting from them, the heavier fall down again towards the bottom, whilst the lighter are supported, by the continual efflux of air, till the successive bursting of bubble after bubble lets them down again into the liquor, and supplies their place with fresh matter. In their passage downwards they are met by other innumerable particles of air, in the same rapid progress upwards, by which they are again carried to the surface, there to be left as before, till by repeated falling, collision, and attrition, some of the oleaginous particles are effectually separated from the earthy, and united with the saccharine, to which they have a natural tendency, as is evinced by the ready incorporation of common sugar and essential oils, by triture only, whence their miscibility with aqueous substances is effected.

This union is no sooner formed, than the continuance of the action proceeds to absorb the finer parts of the earthy principle, which is left floating up and down in the liquor, after its separation from the oleaginous; by which addition, and the intervention of the mucilage, that common medium, which fermentation rather tends to refine than disunite, the whole is converted into a compact and uniform body.

The grosser parts having, by this violent commotion, been completely separated, and the finer recomposed, the more weighty of the former fall to the bottom, whilst the lighter, consisting principally of the refuse mucilage, are carried to the top, where, by their glutinous adherence to each other, being supported by the collected air, they form a yeasty head.

The action now languishes, the vinous fermentation is complete, and all that is wanting, is the prevention of the further progress of the operation, by dividing the subject into casks, where it soon becomes of less heat, by which means the heavier particles condense, and effectually subside; the lighter, by the frequent filling up of the casks, are collected nearly to a point, at the bung-hole, where, being thrown off, they fall down the side, and leave the beer completely purged of all matter which might hereafter endanger a pernicious *stubbornness*, or destructive *fret*.

Were a confirmation of this doctrine necessary, we might perhaps find it in an attentive observance of the effects of fermentation, at different periods of its action. That the oleaginous and earthy principles are first struck out of the body of the wort, is evinced by its remarkably sweet flavour at that time, and the very gross, bitter, austerity of the frothy head, which then contains the greater part of the unattenuated oils and earths; and that those principles do unite and incorporate with the saccharine and mucilaginous, in the latter part of the operation, is proved by the gradual alteration in the flavour of the liquor, from a mixed sweet to a uniform vinosity, and a similar change in the harshness of the yeasty head, which then assumes a like uniformity, so far as the term may be allowed to the aggregated refuse of so many different principles.

The agency of the air, in the business of fermentation, is very powerful, but as all fermentable subjects have an abundant supply, we are rather to provide for the egress of their own, than to suffer the admission of the external air, by which a great number of the fine, volatile, oleaginous, parts of the subject would be carried off, and a proportionate injury in flavour and spirituosity sustained. Hence such a covering should be provided for the gyle-tun as would barely allow the escape of the common air produced by the operation, whilst the *gas*, or fixed air, from its greater density, resting upon the surface of the

the beer the whole depth of the curb, prevents the action of the external air, and consequently the escape of those fine and valuable parts just mentioned.

This probable consequence is the more to be depended on, from the known similarity of effect which gas produces upon flame, which it immediately extinguishes, by preventing that rapid avolation of unctuous particles which is said to constitute flame. In this instance the external air is the agent, which causes and conducts the avolation, and without a continual supply of which it cannot exist; this supply being effectually cut off by an immersion of the subject in the gas of fermenting liquor, the flame is instantaneously extinguished; nor will glowing fire itself exist in it long, though it contributes to rarefy and disperse it; and to animals inhaling it, a death as sudden as by a stroke of lightning is the consequence.

But towards the conclusion of vinous fermentation, this aerial covering begins to lose its efficacy, which points out the necessity of then getting the beer into casks as soon as possible, that the consequences may be prevented, of exposing so large a surface, liable to so copious an evaporation. Amongst these, a loss of spirituosity is not the least; for this evaporation is more and more spirituous, as the action approaches the completion of vinous fermentation; and that once obtained, the loss becomes still more considerable, if still exposed to the air; whence it might be termed the distillation of Nature, in which she is so much superior to Art, that the ethereal spirit rises pure and unmixed, whilst the highest rectification of the still produces, at best, but a compound of aqueous and spirituous parts.

Nor is this entirely conjecture; experience teaches us, that we cannot produce so strong a beer in summer, *ceteris paribus*, as in winter; the reason is, not because the action of fermentation does not

not realize so much spirit in warm weather, but because the fermenting liquor, after the perfection of vinosity, continues so long in a state of rarefaction, that the spirituous parts are dissipated in a much greater degree at that time, than at any other, in a similar state of progression. And this doctrine of natural distillation seems to account for that increase of strength obtainable from long preservation, in well-closed casks, and, more particularly so, in glass bottles; for Nature, in her efforts to bring about her grand purpose of resolving every compound into its first principles, keeps up a perpetual internal struggle, as well as an external evaporation; and if the latter be effectually prevented, the former must be productive of additional spirituosity, so long as the action keeps within the pale of vinous fermentation.

In order to maintain a due regulation of the fermenting power, and to answer the several purposes of the operation, a scrupulous attention to a degree of heat at which the action commences, and a particular regard to the quality and quantity of the ferment employed, are indispensibly necessary.

The quality of the yeast requires the more minute scrutiny, because it is not possible to produce a perfect and effectual fermentation, without it be good, evinced by its lively, elastic, appearance, and powerful effect in application. The quantity can only be ascertained by the intention of the artist. In many instances, a larger portion is tantamount to a higher degree of fermenting heat, and *vice versa*; but this is chiefly confined to the purpose of accelerating the process. If the operation be too languid, from a want of heat in the fermenting liquor, an addition of fresh yeast may supply the deficiency, and effect the required recomposition of parts, without which there is not only an immediate loss of strength, but such a derangement of the preservative principles, as will effectually prevent their re-union, and leave the imperfect product to the certainty of

early destruction. The action, in this instance, having only sufficient force to separate, and being unable to attenuate and recompose the oleaginous and earthy parts of the subject, the body of the beer remains a heavy, unconnected farrago of the whole constituent principles, of a fulsome, sweet, mawkish flavour, prompt to a stubborn fret, on the first change of air, and consequent acidity, the final period of its existence as a vinous liquor.

This, also, leads us to the necessity of completing the vinous fermentation, previous to *cleansing*, or putting the liquor into casks, which change of quantity and situation alters the action from fermentation to *purgation* only; for those parts which in the gyle-tun are carried to the top, and repeatedly fall again into the body of the liquor, to be there further separated, attenuated, refined, and recomposed, are, in the cask, thrown off entirely, and perish in the *stillion*, or receiver, before they can be returned again, by filling up the vessel.

The consequences of such a violent disunion have been before noted; to which may be added, the great loss of spirituosity, occasioned by so premature a division of the fermenting liquor into smaller quantities, which immediately checks the operation, and prevents its being brought to a proper crisis, both from the preternatural discharge of the cask, and the want of a sufficient body to accomplish that end; for it is not in the power of art to produce a proportionate quantity of spirit from a small body of wort, to that which is obtainable from a large one, though of equal quality in every respect.

The effects of a contrary conduct, in suffering the liquor to remain in the tun after the period of vinous fermentation, have been already sufficiently intimated; but the criterion which marks the exact period of maturity, resting more upon the discrimination of the senses than an appeal to the understanding, we must leave to the illustration

illustration of practice what lies beyond the documents of theory to define.

In these strictures, the *use of the thermometer* has been all along implied, without which, all theory is ineffectual, all practice uncertain. We have seen that the variation of a few degrees of heat in forming the extracts, produces an important difference of effect. In the heat of fermentation, similar consequences result from similar variety. Under a certain regulation of the process, we can retain in the beer, as far as art is capable, the finer mucilage, and thereby preserve that fullness upon the palate which is by many so much admired; on the other hand, by a slight alteration, we can throw it off, and produce that evenness and uniformity of flavour, which has scarce any characteristical property, and is preferred by some, only for the want of that heaviness which they complain of in full beers. If a more vinous, racy *ale* be required, we can, by collecting and confining the operation within the body of the wort, cause the separation and absorption of such an abundant portion of the oleaginous and earthy principles, as to produce a liquor in a state of perfection at the earliest period, and so highly flavourous, as to create a suspicion of an adventitious quality.

Thus, by a judicious management of this most difficult and interesting part of the brewing process, we are enabled to influence natural flavour, spirituosity, and preservation. By a further improvement, we can introduce foreign virtues, (as in the instance of *porter*, &c.) anticipate age, and produce in two months the properties and characteristics of twelve.

OF THE FERMENTABLE MATTER EXTRACTABLE FROM MALT.

Mr. Richardson observes, the value of Malt consisting in its dissoluble parts, and these being obtainable in different proportions, according to the quality of the barley employed, or the skill of the maltster in conducting the process of its vegetation, it is matter of surprise that some certain means have not before been invented to regulate what the brewers term the *length* (i. e. the quantity of beer to be made from a given quantity of malt) rather by the *quality* than by the *quantity* of the malt made use of. When the brewer says he draws one and an half, two, two and an half, or three barrels from a quarter of malt, it means no more than that he employs so much malt to make so much beer, without conveying any determinate idea of the quality of either. He may, indeed, premise that his malt is of a good, bad, or indifferent quality, for the sake of distinction, and yet we are left to make a very vague guess at the result of its application; for the terms *good* and *bad* are totally indefinite, unless applied in reference to a standard established on the broad basis of mathematical certainty. In the present case, an instrument which will ascertain the quantity of the dissoluble parts, or of the fermentable matter extracted from malt of every kind, will not only discriminate its value, but point out the value of the liquor produced from it, in explicit and communicable terms. This is what the brewer has long wanted; for though he could tell that stronger beer might be made from better malt, or from a greater quantity of the same malt, yet he has ever been at a loss to determine in what proportion it would be better, were such superiority or addition to take place. The instruments hitherto published, * with the view of assisting him herein, have been totally incompetent to the purpose. Many reasons might be adduced in

* Quin's excepted.

in support of this assertion, without derogating from the ingenuity of the inventors or publishers; but one will suffice:—They were the attempts of men, who, not possessing the means of information adequate to the end proposed, could have no applicable foundation whereon to build a system of that certain and complete utility which the subject requires, and of which it is capable.

The instrument now offered to the public, shewing how many pounds avoirdupois of fermentable matter are contained in every barrel * of wort extracted from the malt, leads immediately to the discovery of what portion of the latter has been imbibed by, or incorporated with the extracted menstruum, and of course, what has been the product or intrinsic value of every quarter of malt employed; pointing out, at the same time, how much of that product is contained in a barrel of wort in a fermentable state, whether entire or a commixture of several; thence establishing a mathematical definition, which conveys positive ideas on the subject, and cannot be misunderstood.

By the long-continued use of this instrument, in my own practice, as well as from its occasional application elsewhere, I am authorised to pronounce it the most useful, because the most advantageous instrument the brewer can adopt. The discoveries it has laid open to my view, have been of so interesting a nature, that I have often been struck with astonishment to find that common observation and attention should be so inadequate to the purpose of securing or obtaining so very important advantages, derivable from a very common profession, which has been so long involved in darkness and error, as to create a vulgar opinion, that it neither requires nor admits of science nor system.

In

* Thirty-six gallons, beer measure, as before explained.

In the course of my experiments I have found, that by means of the saccharometer, or thermometer, I am enabled to estimate the intrinsic worth of every kind of malt, to the very great precision of the one thousandth part of the fermentable matter extracted from every quarter employed. And by estimates made in this manner, I have discovered a great variety in malts, which, but for these discoveries, would scarcely have been deemed of different value. From such as have fallen under my observation in practice, during the three years preceding the first publication of this treatise, I have selected the following, the respective value of which will be known by the sum of the fermentable matter severally extracted from them.

MALT *from the Barley of* 1781.

No.	*Colour.*	*Character.*	*Growth of Barley.*	*Average prod. of fer. matter.*
1	pale	well made	North Lincolnshire	82 pounds
2	ditto	indifferent	ditto — —	75 ditto
3	ditto	well made	Norfolk — —	72 ditto
4	ditto	ditto	Yorkshire Woulds	82 ditto
5	brown	ditto	ditto — —	78 ditto
6	ditto	ditto	Ware, in Herts.	56 ditto

MALT *from the Barley of* 1782.

No.	*Colour.*	*Character*	*Growth of Barley.*	*Average prod.*
1	pale	well made	Yorkshire Woulds	62 pounds
2	ditto	ditto	Bremen — —	58 ditto
3	ditto	ditto	Norfolk — —	67 ditto
4	ditto	indifferent	ditto — —	56 ditto
5	brown	well made	Ware, in Herts	54 ditto

MALT

MALT *from the Barley of* 1783.

No.	*Colour.*	*Character.*	*Growth of Barley.*	*Average prod.*
1	pale	well made	North Lincolnshire	74 pounds
2	ditto	ditto	Berwick on Tweed	63 ditto
3	ditto	indifferent	Yorkshire Woulds	65 ditto
4	ditto	well made	ditto — —	75 ditto
5	brown	ditto	ditto — —	72 ditto

The average products, above quoted, are all deduced from the different produce of different brewings, made from the same parcel of malt, which sometimes varied a few pounds from the respective averages here stated; and this variation might arise from an essential difference in the malt itself, owing to the different degrees of perfection to which the vegetative process of different floors might have arrived, though consisting of the same kind of barley; or it might result from the difference in grinding the same malt rounder at one time than at another; for the intention of malting being the production of that saccharum, and other dissoluble parts which constitute the value of malt, it follows, of course, that in proportion as that process approaches to perfection, the increase of those valuable parts will be effected; and as the crushing of every kernal in pieces is indispensable to the setting at liberty its fermentable matter, it is obvious, that if the operation of grinding be so carelessly performed, that a certain number pass through the stones unbroken, the product must be less in the proportion which these bear to the whole volume. Hence a continued attention is necessary to these preliminary particulars, as a foundation for those advantages which are to result from posterior considerations.

The different products of the different specimens above-stated convey important information to the brewer, and suggest a vast field of beneficial enquiry. By those we see, that good pale malt, from stout

stout barley, will produce, in the ordinary mode of practice, eighty-two pounds of fermentable matter; and this produce the barley of most of the inland counties is capable, and that of some will exceed it. We also see, in the fourth and fifth articles of the year 1781, that brown (not *blown*) malt, produces seventy-eight pounds per quarter, made from the same barley, and by the same process of vegetation, which in pale produces eighty-two; and that the Hertfordshire barley, in the sixth article, generally superior to that alluded to, made into brown malt, by the Ware practice, produces only fifty-six. By the former practice, there is a deficiency in the produce of brown malt, of about five per cent. by the latter the loss is more than thirty; a difference so very great, that were it not mathematically demonstrable, credibility would be staggered at an assertion which seems so severely to reflect on the judgment of many people, whose predilection for Ware malts has been of long standing, particularly in London, where they are most sought after, and bear the best price. It is, indeed, with the utmost respect, that I submit to the consideration of the gentlemen who stand in this predicament, the difference here announced between brown malts dried in the common method, and those which are *blown*, by the precipitate mode practised at Ware and its environs.

Independent of the demonstration of this error by the saccharometer, or thermometer, I need only appeal to the understanding of any person, whether he be conversant or not in the nature of malt, to bear testimony of its existence, however indefinite in degree it may be found, in the want of the demonstrative means here alluded to. For were such a common observer to be informed, that every kernel of blown malt is of a magnitude exceeding the bulk of the barley from which it was made, in a ratio of four to three, or thereabouts, and that this excess of magnitude is occasioned only by a rarefaction of the air within, arising from a sudden application of violent heat to the green malt, which puffs up the outer skin, like a bladder filled

with

with air, in which state it is fixed by the continuance of the heat, he will immediately conclude, that the cavity found in every kernel, though it may very well serve to buoy up its fellow, and fill the bushel, will produce no fermentable matter in the mash-tun :—*ex nihilo nil fit.*

It may be farther observed, on the defects of brown malts in general, compared with pale made from the same species of barley, that the process of brewing porter, and other beers, in which a portion of brown malt is necessarily introduced, is more productive of fermentable matter than that which common usage has adopted, where pale malts only are employed; the rational inference of this is, that the real deficiency of the former is greater than it appears to be in the experiments adduced; because the products therein stated are those of the different processes just alluded to, and not comparative views of the products resulting from the same process; a circumstance which, in the practical and separate use of brown and pale malts, very rarely occurs.

From the above view of the malts produced from the barley of 1781, which was in a state of general perfection, much more useful information may be collected. The two first articles are specimens of the produce of the same kind of barley, under the management of two different maltsters. In the former there is a superiority over the latter of nine per cent. a considerable difference, to an amount which, in most commercial concerns, is deemed a fair profit; and yet these two parcels of malt would have passed, among common consumers, with this simple observation, that *this sample is freer than that*; the difference in sale would not, perhaps, have exceeded a shilling per quarter; and the brewer would have thrown them indiscriminately into the mash-tun, drawing his usual length from each, to the positive loss of nine per cent. either in the quality of his liquor from the latter parcel, or in the obtainable profits of his trade

 from

from the former; which ever might happen to tally with the general quality of the malt he used.

The third article leads us to the detection of an error generally prevalent in the northern parts of the kingdom, which is, the preference given there to Norfolk barley. Yet this preference has a very rational foundation, so far as it is found to be more vegetative, or to *malt more freely* than the native barley of those parts. Nevertheless, this is too often to be attributed more to the ignorance of the maltster, than to the quality just mentioned. If the specimens here quoted (made from a fair parcel of Norfolk barley, under the inspection of a friend, whose knowledge of the malting business is very extensive) be compared with that made from the Lincolnshire barley in the first article, we shall find a difference in favour of the latter of twelve and an half per cent. and surely no person, after such a demonstration, would be weak enough to give a superior price for a commodity deficient in value to so considerable an amount.

The barley of the year 1782, presents us with a melancholy spectacle of the effects of that ungenial season. The first article exhibits the produce of the same maltster, occupied upon barley from the same place which is quoted in the fourth article of the preceding year, and "what a falling off is there!"—an advance of one hundred per cent. in price, with a reduction in quality of near twenty-four per cent. more, must necessarily have reduced the brewery to a situation to which few other professions are liable; because most manufactories advance the price of the commodity in proportion to the advance on the materials, a circumstance which can rarely take place in the brewing business. The barley from Bremen, mentioned in the second article, though apparently much inferior to the preceding, was nearly equal in produce; because it germinated freely, whilst a great part of the other remained unmalted. And this accounts for the Norfolk barley of that year having a real superiority. It was gathered in so much

much better order than the barley of the northern counties, which was in a great measure spoiled, that opposing the best of both sorts to each other, it was both superior in appearance and produce. From a similar cause, there appears less difference between the two seasons of the blown malt of Hertfordshire than the rest, for the southern situation of that county is generally more favourable to the husbandman, in gathering the fruits of his labour, than can be expected in the more northern counties.

The last season, (1783) though yielding a providential relief, was still very inadequate to the supply of the distressing deficiency caused by the preceding year. The backwardness of the northern harvests subjecting them to the autumnal rains which took place after the southern counties had finished their harvests, did irreparable damage to the barley; whence the obvious difference between the produce of that and the barley of 1781, though happily much superior to that of 1782. The falling off observable in the third article, arose partly from the indifferent quality of the barley, which was sprouted and much injured by the weather, and partly from the want of attention or skill in the maltster; from which causes it barely exceeded the second article, which was from very thin barley, produced in the neighbourhood of Berwick upon Tweed, but which worked tolerably well upon the floor. It is also worth observation, that the deficiency in the brown malt of the fifth article, bears nearly the same proportion to the quality of the pale, in the fourth, that it did on the same occasion in 1781.

I wish it to be here particularly noted, that the several sums of the fermentable matter extractable from different malts, as above stated, are those obtainable in the *ordinary way of practice;* but that by a particular modification of the extracts, and regulation of the process of brewing, an addition thereto may be made, well worthy the brewer's attention. It is impossible to say what may be the amount

 of

of this addition in every case, because it must necessarily vary with that variety of practice observable in various situations and circumstances; but this I may venture to assert, that the general adoption of that mode of practice, which is meant to be reserved for particular communication, would effect a saving in the consumption of malt in this kingdom, of at least five per cent. without the smallest diminution of the respective strength of the liquor produced from it. And I am confident in the assurance, that the advantage here alluded to, is not the hypothetical conclusion of a visionary system, but the real, solid, attainable, benefit, arising from a particular mode of practice, which I have successfully adopted for a length of time sufficient to warrant its reality; nor is it over-rated, in the general estimate, if I may be allowed to judge from a comparison of my own practice with that of others known to me in different parts of the kingdom. I also make a reservation of the event of this comparison, for no other reason than the probability that its publication might not be deemed proper to meet the eye of every reader. *

From the foregoing premises may be drawn inferences very favourable to the general use of the saccharometer in the brewing business; and should its reception be such as the importance of the subject seems to claim, I may hereafter be induced to recommend an apparatus for ascertaining the value of malt to the purchaser or maker, independent of the consumer; in order that the buyer and seller of that article may adopt a clear and explicit language, conveying definite ideas, which by common usage may become as familiar to each other, and as well understood, as the terms made use of by the importers and dealers in spirits; the value of which, but for the use of a similar instrument, would be as vague and indefinite as that of malt now is, estimated

* I however think myself at liberty to declare, that from the barley of 1786, I have brewed pale malts, which have produced, by the practice here alluded to, eighty-eight pounds per quarter on an average, and some have amounted to upwards of ninety-one.

estimated by the barbarous test of mastication, or the equally uncertain one of floating in water, productive of no clearer language than is couched in the very equivocal terms of *bad, flinty, steely, hard, stiff,* and their opposites, *good, tender, free,* &c. &c. to which no positive idea can be affixed, because they are relative to no standard of comparison.

Of estimating the VALUE OF MALT, *and of regulating the* LENGTH, *or establishing a Standard Strength for Beers of every Denomination, by the Fermentable Matter extracted.*

FROM what has been before said, it will be readily suggested, that as the value of malt arises entirely from the quantity of fermentable matter it produces, the language of brewers, adopting the use of the saccharometer, will be, that "this or that malt producing so many pounds more or less per quarter, is of course in that proportion more or less valuable;" and if we establish eighty-two pounds produce as the standard of what is now termed *good malt,* and estimate it somewhat lower than the present exorbitant price,* *viz.* at forty-one shillings per quarter, for the sake of an easy calculation, we shall see that six-pence per pound is the value of the fermentable matter of malt, estimated at that price per quarter; and that, therefore, the proportionate value of the malts of 1781, quoted before, will stand precisely thus:

1. Good

* The price in 1784.

		per Quarter.		
		l.	*s.*	*d.*
1.	Good *pale malt,* from Lincolnshire barley — —	2	1	0
2.	Indifferent ditto, ditto — — — —	1	17	6
3.	Good *pale malt,* from Norfolk barley — —	1	16	0
4.	Ditto ditto, from Bridlington barley — —	2	1	0
5.	Good *brown malt,* from the same kind of barley —	1	19	0
6.	Ditto ditto, from Ware *(blown)* — — —	1	8	0

On this view of the real, intrinsic value of the above malts, which value is demonstrable to as great certainty, and by as easy a mode as the strength of spirits is ascertained, no farther comment is necessary than the simple observation, that the difference in the first and second articles arose from the different skill of the different maltsters by whom they were made ; the inferiority of the third resulted from that inferiority of the barley, the defects of which the best artist cannot supply ; the fourth and fifth shew the disadvantageous effect of drying malt brown, though of equal quality on the floor, and cured upon the same kiln ; and the sixth expresses the deficiency produced by the practice of *blowing* up three kernels till they nearly occupy the space of four ; the natural inference of which is written in such broad characters as to preclude the necessity of farther display ; for "he who "runs may read."

To reduce into order this very great irregularity, and to establish a standard by which the essential value of all malts might be estimated, and that every relative of that estimate might be reciprocally communicated amongst those interested in the sale or consumption of malt, in clear, and unequivocal terms, it would be necessary to lay down certain rules, and to establish a certain criterion of perfection, by which the quality of every species might be immediately tried, and explicitly communicated, as soon as discovered ; in which business the term *par* being adopted by the dealers in malt, with the same intention as that

that of *proof* has been by the dealers in spirits; and that *par* being fixed at seventy or eighty pounds per quarter produce, the distinction of so many pounds above or below *par* would be as definite and comprehensive to the former, as that of so much above or below *proof* is to the latter; particularly if recourse could be had to an apparatus similar to that intimated in the last section, to correct their judgment and corroborate their assertions.

As the mode of forming this estimate of the fermentable matter extractable from malt consists, at present, in knowing the number of barrels of wort extracted from it, and discovering how many pounds each barrel contains, we are thence led to calculate the aggregate or sum of the fermentable matter produced by the malt employed, and to divide that aggregate into so many portions, or equal parts, as we wish to have barrels of wort in a fermentable state, or barrels of beer after the fermentation is finished; thereby providing for the establishment of a certain standard, or uniform strength, let the quality of the malt employed be good or bad. Hence, if the brewer has generally been accustomed to the use of indifferent malt, and should become possessed of some of superior quality, he may, at a certainty, reap every advantage accruing from that superiority, and not blindly waste it in a superfluous strength of his liquor; or, if he has commonly used good malt, and should accidentally purchase or make a parcel of inferior quality, he needs not risk the loss of his credit by an unforeseen or unintended diminution of that strength which the consumer of his liquor expects to find; neither of which can be avoided by the present random estimate of *so many barrels per quarter*, in lieu of the more accurate one, here inculcated, of *so many pounds of fermentable matter per barrel.*

To accommodate this to the practice of every brewer, no general standard is necessary; because the criterion of perfection in malt-liquors, as in most other articles of domestic consumption, existing principally

principally in the taste of the consumer, and that taste being as various and indefinite as the complexions, inclinations, and manners of the deciding parties, it is incumbent on every brewer to fix upon that standard strength, or final specific gravity of his wort, which by experience he finds productive of the required strength of his liquor. For instance, should he discover, from a repetition of experiments, founded on his usual mode of practice, that twenty-five pounds per barrel is the gravity which produces sufficient strength for his general trade, he is then to establish that, in his own mind, as his standard strength, which he ought always to produce, and which he needs never to exceed; for, should the aggregate extract of his malt produce, on a division into the number of barrels usually contained in his length, a superior gravity, only in the ratio of one pound per barrel, making twenty-six instead of twenty-five pounds, he would lose an attainable advantage of sixpence per barrel (at the price of malt above-quoted) if he did not make such an addition to his length, as should liquidate that superiority, and leave his wort in its standard state. On the contrary, should the aggregate extract, on a similar division, fall short of the intended standard, the length, in the present process should be lessened by extraordinary evaporation, and, in the future, by less copious extracts.

From a transient view of this subject, a person might be led to imagine, that if eighty pounds, for instance, are extracted from a quarter of malt, a length of two barrels per quarter would, of course, produce forty pounds per barrel; that of two and an half, thirty-two pounds; and other lengths in the same proportion. This, however, would be a fallacious estimate. The quantity of hops used makes a considerable and perpetual variation herein; for though the dissoluble parts of that vegetable produce some addition to the gravity of the wort, yet the quantity imbibed by the hops exceeds the amount of that addition in so great a degree, as to make a considerable and irretrievable diminution in the aggregate of the fermentable matter extracted.

extracted. But, in order to convey some idea of this matter, it may be observed, that the general product, by the general practice of the brewery, of what is termed *good malt*, is, upon an average, nearly as follows:

	per Barrel. Pounds.
Burton ale, of 36 to 40 gallons per quarter — —	40
Country ale, of 2 barrels — — — —	32
Ditto, of 2 barrels and a firkin — — —	28
Ditto, of 2 barrels and an half — — —	26
Porter, of 2 barrels and an half — — —	26
Ditto, of 2 barrels and three firkins — —	24
Ditto, of 3 barrels — — — —	22

These averages are, nevertheless, so liable to variation, from the variety of processes adopted by brewers, and the various qualities of the malt made use of, that they are by no means intended as certain standards capable of becoming a rule for general practice; though an occasional reference to them may not be unuseful.

But, to return to the regulation of the length, or final average gravity of the wort, I have to observe, that as the amount of the diminution above-mentioned will be the subject of our future discussion, I shall here only intimate another difficulty which occurs in attempting to make the most advantageous division of the aggregate extract into the intended proportions, and this exists in the incompetency of the ordinary practice of the brewery to the obtaining *all* the fermentable matter which it is practicable to extract from malt, the explanation of which is reserved for the particular communication before alluded to.

To remove, however, those obstacles which occur in the regulation of so much of the fermentable matter as is obtainable in the common mode of brewing, an attention to the following considerations is necessary, *viz.* that every wort to be assayed must previously be brought to that degree of heat which is established as a standard temperature for the instrument; or a calculation must be made, to reduce it to that temperature, in order to determine what its quantity and quality would be, when so reduced; because the expansion, or increased volume of fluids of different densities, is not in the same ratio by the application of the same degree of heat, nor is the difference of their increase in proportion to their densities. To obviate this difficulty, I have been induced to give, with the instrument, the *Table of Expansion,* which, shewing the degree of expansion in worts of different gravities, from one to sixty pounds per barrel, enables us to ascertain the different volumes of the same quantity of wort at different degrees of heat, from fifty to two hundred, by Fahrenheit's thermometer; as well as the *Table of Heat,* before mentioned, pointing out the difference between the apparent and the real value, or specific gravity of worts of the same variety, noted at every pound per barrel, and at every degree from fifty to one hundred, by the same thermometer; which tables include every practicable density and heat. To have extended this table beyond its present limits, would have subjected the investigator to inconveniences which will be mentioned hereafter.

Being enabled hereby to determine, with precision, the actual specific gravity of every extract, when at fifty degrees of heat, and to ascertain what would be the precise quantity, at the same temperature, so as to calculate therefrom the number of pounds of fermentable matter contained therein; we are next led to consider how this aggregate of fermentable matter shall be so disposed, after the action of boiling, and its subsequent cooling shall have taken place, as to produce the exact number of pounds per barrel, which I have established

established as a standard, productive of the required strength in our liquor.

In extracting from the malt the requisite quantity of wort, the experienced brewer will not be at a loss, but in the evaporation which takes place in the copper, especially where long boiling is required, the uncertainty is so great, that we can never be assured, by any rule hitherto known in the brewery, that we shall produce the desired quantity, and are thence frequently led into great and disadvantageous irregularities.

To surmount this difficulty, were no hops employed, we need only have recourse to the rule mentioned under the article *Evaporation*, and estimating thereby how much of the aqueous parts of the wort ought to be evaporated, during its continuance in the copper, immediately calculate its required gravity at the moment of its being turned out. Thus, if a wort containing forty barrels, at a gravity of thirty pounds per barrel, were required to be boiled down so as to produce forty pounds per barrel, in a fermentable state, the proportion to be evaporated must, of course, be one-fourth of the whole quantity, or ten barrels; but supposing three of those ten barrels to be the amount of the evaporation, from the period of turning the wort out of the copper to that of its being in a fermentable state, the evaporation of the copper will be only seven barrels. Whence dividing one thousand two hundred pounds, the aggregate of the fermentable matter contained in the wort, by thirty-three, the number of barrels to which it is reduced in the copper, the quotient will be somewhat more than thirty-six; which would indicate the specific gravity the wort ought to have, when evaporated by boiling to thirty-three barrels. As soon, therefore, as the instrument (by a repetition of occasional experiments) shews the wort to be thirty-six pounds per barrel, it should be immediately *struck*, or turned out of the copper, and the then quantity would undoubtedly be thirty-three barrels,

 though,

though, from the great irregularity of a violent ebullition, the guaging rod could not have ascertained the quantity at that time.

But since hops must be made use of, we have to encounter fresh difficulties arising therefrom. In addition to the one thousand two hundred pounds of fermentable matter, in the case before us, there will be to include the extractable parts of the hops employed; from the sum of which is to be deducted the quantity of wort imbibed by the hops, or rather the amount of the fermentable matter contained in the quantity so imbibed, and the difference will be the net aggregate of the fermentable matter extracted; which, divided by the standard strength intended, the quotient will shew the number of barrels producible therefrom. The application of the instrument herein will be precisely the same as in the case just quoted, with the advantage of proving the total incompetency of the guaging-rod; because the space occupied by the hops, the amount of their absorption, and the ebullition of the worts, render all attempts to ascertain the quantity by a guage, nugatory and impracticable.

These considerations seem to claim the attention of every brewer who boils his worts by time, particularly during so long a term as is requisite in the porter brewery; in which the irregularity of length is sometimes very considerable. If the end of decoction (exclusive of the purpose of extracting the preservative qualities of the hops) be to evaporate a certain portion of the aqueous parts of the wort, in order to inspissate and render more preservable the remainder, it appears quite indifferent whether the obtaining that end, to the degree which the experience of the brewer has shewn to be necessary, be effected in one hour or in five hours. When once obtained, whether in a short or a long time, by means of a quick or a slow fire, by a violent or a gentle ebullition, the application of the saccharometer will assure the brewer that he needs neither err in his quantity or quality; " a consummation

consummation devoutly to be wished" by all who are interested in the emoluments of large breweries.

To facilitate these several particulars, the average amount of the extract from the hops is hereafter ascertained in its proper place, and a *Table of the quantity of the Wort imbibed by different quantities of Hops,* is added to those before-mentioned, as given with the instrument; to which is likewise added, a *Table of Measure,* reducing barrels of thirty-six gallons into those of thirty-four, for the use of such persons in the country whose barrels are of the latter contents.

The utility of these tables will be obvious to those who are not expert at calculation; and to those who are, a saving of their time and trouble will be some recommendation of them.

From what has been premised on the subject of the theory and principles of the saccharometer, I presume the reader will be sufficiently prepared to enter upon the practical part, to which I now proceed.

EXPERIMENTS AND PRACTICE.

In order to apply, in practice, the doctrines inculcated in the former part, it may be necessary to advert to the experiments upon which they are founded, and to recur to those practical corroborations which at once exemplify, illustrate, and establish them.

For this purpose we will set the general process of brewing before us, and note the application of the saccharometer in the several stages of its progress, as they occur.

Of applying the Instrument to the Simple Extract, or the Wort in the Under-Back.

So soon as the *tap is spent*, or the wort all drained from the malt into the under-back, by dipping it with a guage we ascertain the number of barrels extracted; by taking the heat of it, we determine its state of expansion; and by preserving a specimen in the *assay jar*, we are enabled to discover its specific gravity, the moment it is cooled to an experimentable degree of heat*. In this business, as I have before intimated, the circumstance of evaporation is of no account; because the wort is immediately pumped up into the copper, and is subject to no material evaporation, but what is the object of subsequent attention. Its state of expansion, however, requires consideration; because the guage, taken as above, can only determine the volume, or number of barrels, at the degree of heat which it then happens to contain, but does not shew the number of barrels to which the same would be contracted, at any of those degrees to which the application of the instrument is necessarily limited; and therefore, without this consideration, the quantity of wort would be falsely estimated, and the aggregate acquired density, or sum of the fermentable matter extracted, would of course be wrong.

This

* The reason of limiting the degree of heat for experiments to one hundred, is to prevent incorrectness in applying the instrument; for, at a higher degree, the heat being less stationary, an error might arise from the decrease which would take place during the experiment.

This circumstance induced me to investigate the principle of expansion, as relative to the business in hand, by means of the apparatus before described, and to form the table, on that subject, before referred to; by the assistance of which we come at once to the desired information. For instance, in a brewing of twenty-four quarters of malt, my first wort in the under-back was thirty-two barrels, the heat of which being one hundred and forty-five degrees, by Fahrenheit's thermometer, I took out my specimen, and cooling it in the assay jar, found its specific gravity to be 28.25 pounds per barrel. On referring to my experiments on the subject of expansion, I found that in a wort of that strength, the amount of the expansion at one hundred and forty-five degrees, is in a ratio of 1.69 per cent. *i. e.* one hundred barrels of wort of that specific gravity, and at that degree of heat, would be 1.69 less in bulk, or only 98.31 barrels in the whole, when cooled to fifty degrees, supposing all evaporation to have been prevented. Therefore, as 100 is to 98.31, so is 32 to 31.47, which shews that my thirty-two barrels, if suffered to have cooled to the standard temperature of the instrument, would have been only 31.47, or not quite thirty-one barrels and an half. To find the aggregate of the fermented matter extracted in this wort, I multiplied 31.47, the quantity, by 28.25, the specific gravity, and the product was 889 pounds.

My second wort, from the same malt, was thirty barrels, at one hundred and sixty degrees of heat, and its specific gravity was 17.6 pounds per barrel. Making again the same reference as in the former wort, I found that the amount of the expansion of this wort was two per cent. and that, by the same rule of proportion, my thirty barrels were only 29.4 at the standard temperature. Hence the product of that quantity of wort, multiplied as before by its specific gravity, was 517.4 pounds, the aggregate of the fermentable matter contained therein.

A third

A third wort was thirty-one barrels at one hundred seventy degrees of heat, and its specific gravity was 9.25 pounds per barrel; the expansion of which amounting to 2.33 per cent. I found, by similar modes of enquiry, that there were only 30.26 barrels, the aggregate fermentable matter of which was 279.9 pounds.

These aggregates being all added together, the sum of the fermentable matter extracted appeared to be 1686.3 pounds.

Without having taken into consideration the state of the expansion of these worts, they would have stood thus:

Wort.		*Barrels.*		*per Barrel.*				*Pounds.*
First	—	32	at	28.25	—	produces	—	904.0
Second	—	30	—	17.6	—	———	—	528.0
Third	—	31	—	9.25	—	———	—	286.7

Apparent sum of the several aggregates of fermentable matter	1718.7
From which deducting the true sum	1686.3
The difference is	32.4

being the amount of the error which would have arisen from a calculation founded on these erroneous principles.

In conducting these experiments I had always the precaution to guage the wort, and take the specimen out of the under-back, as before recommended, just at the time the wort was about to be pumped into the copper, the mash-cocks being turned off. Had it been heedlessly guaged at an earlier period, the draining from the mash-tun, however inconsiderable in appearance, might have made

too considerable an addition to the quantity to have passed unnoticed; and had the specimen been drawn from the last running of the wort, which is of a more dense consistence than the first, instead of being taken out of the under-back, an error of some importance, on the contrary side, might have been occasioned thereby.

The covering up the specimen in the assay-jar had, also, been as carefully attended to, in order to be assured, that as it was at the moment of being taken out an exact sample of the wort at that time in the under-back, though too hot to have its gravity immediately ascertained, so it might continue its faithful representative when reduced to a lower temperature; for though an evaporation takes place during the time of its cooling, yet the vapour being confined by the cover and prevented from escaping, becomes condensed by the coldness of the metal, and returning in drops, again mixes with the wort, which is thereby restored to the same state in which it was when first put into the jar.

The result of these observations being duly noted, I had only to wait the event of the subsequent parts of the process, the investigation of which was as follows:

Of the Effects produced in the Density of Worts by Boiling, *and by the Addition of* Hops.

Having boiled the first wort, abovementioned, its usual time, I found that of the 31.47 barrels there remained only 21.5 when properly cooled; and on applying the instrument to discover its specific gravity, I perceived that it had increased to 34.25 pounds per barrel. Multiplying, therefore, 21.5 by 34.25, the product of which was only 736.375 pounds, and deducting that sum from 889 pounds, the sum of the fermentable matter originally extracted, I discovered a

 deficiency

deficiency or apparent loss of 152.625 pounds of that fermentable matter. Being well aware that this deficiency could not arise from evaporation, which, as before explained, can only carry off the aqueous particles, I was convinced that the absorption of the hops used was the true cause of the loss, which induced me to commence an immediate enquiry on that subject.

In order to discover what addition is made to the density of wort by hops, as a preliminary step to the discovery of what they imbibe, I took half a pound of good Kent hops, and boiled them in water, as under:

First, in one hour, 12 pints of water were reduced to 7.5 pints, the specific gravity of which was 1.75, or one pound and three-fourths per barrel.

2. The same hops in 12 other pints of water, which in one hour was evaporated to 9.4 pints, whose specific gravity was 0.5, or half a pound per barrel.

3. The same in 12 pints more, which in the same time evaporated to 9.8 pints; the specific gravity 0.22.

4. The same in 12 pints more, which in the same time evaporated the same amount as the last, and its specific gravity was only 0.125.

From these experiments it is evident that the first extract is nearly two-thirds of the produce resulting from four fresh applications of water, and as the hops used herein were in the proportion of 19 pounds to a barrel, in the first experiment, the extract of which was so inconsiderable as 1.75 pounds in 7.5 pints, I thought the succeeding extracts too immaterial to be noticed in practice; for which reason, as

as well as for considerations which will appear hereafter, I included the application of the first extract only.

The proportion of hops above-mentioned was thus ascertained; As 7.5 pints, the quantity of the first extract, are to 0.5 pound, the quantity of hops used, so are 288 pints, the contents of a barrel, to 19.2 pounds, the proportion of hops per barrel, in this experiment. And the true specific gravity of the first extract was thus found: I divided 19.2, the hops per barrel, by 36, the number of gallons per barrel, and the quotient 0.53 shewed the proportion of hops per gallon. Then saying as 0.5, the quantity of hops used in the experiment, is to 0.53, the proportion per gallon, so is 1.75, the specific gravity of the quantity extracted, to 1.86, the true specific gravity of the extract. Finding this so very near the proportion of 10 to 1, to avoid fractions, and unnecessary references to tables, I established it as a rule, that ten pounds of hops will produce one pound additional density to the wort; and accordingly for three hundred pounds used in the wort above quoted, I added thirty to the sum of fermentable matter, (eight hundred and eighty-nine) making in the whole nine hundred and nineteen pounds.

I am not unapprized of an objection which might be made to the general establishment of this calculation of the hop extract, on account of the irregularity which different lengths of time in boiling might occasion, and of the greater facility with which water may extract the dissoluble parts of hops, thence tending to invalidate this proportion as inapplicable to an extract made with a dense wort: but as I have only taken the first extract into my account; as other experiments of the same nature have tended to establish this proportion; and as its accuracy has been sufficiently confirmed by actual practice, it may be relied on to answer the purpose of the nicest practitioner.

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My next enquiry was directed to the discovery of the quantity of wort generally imbibed by hops, in order to enable me to account for the present deficiency, and to ascertain the amount of such as must necessarily happen in future.

I inclosed half a pound of good hops in a tin case, perforated with small holes, and sufficiently large for the purpose, suspending it by a string in the middle of a copper of first wort, which was suffered to boil one hour and an half. It was then hung up to drain till the inclosed hops were in the same state with those in the hop-back, from which the whole wort had drained. I next weighed a pint of the wort, when at a standard temperature, and found it to weigh nine thousand eight hundred and sixty-two grains net. The original weight of the hops (calculated at four hundred and forty grains per ounce, from the necessity of making use of weights so proportioned) was three thousand five hundred and twenty grains, which by the addition of the imbibed wort was increased to twenty-five thousand and eighty. The dissoluble parts of these hops which must have been extracted, amount to three hundred and fifty-two grains, according to the proportion above stated, which being deducted from three thousand five hundred and twenty, their first weight, there remained three thousand one hundred and sixty-eight grains, being the then net weight of the hops, independent of the worts actually imbibed. I had now to deduct the said three thousand one hundred and sixty-eight grains, net weight, from twenty-five thousand and eighty, the gross weight of the whole, and the difference, twenty-one thousand nine hundred and twelve, was the true weight of the wort imbibed by the hops; which being divided by nine thousand eight hundred and sixty-two, the net weight of one pint, the quotient, 2.22 pints, shewed the exact amount of the quantity imbibed by half a pound of hops. According to this calculation, somewhat less than sixty-five pounds of hops will imbibe one barrel of wort, when well drained; but, as the expedition required in practice will not admit of

a scru-

a scrupulous observance of every nicety, I find, from long experience, that the average may be estimated at sixty pounds of hops, as generally imbibing a barrel of wort; which estimate, also, from different experiments, wherein measure instead of weight has directed my calculations, is sufficiently corroborated and confirmed.

Having procured this information, I discovered that my three hundred pounds of hops had imbibed five barrels of wort, which, at 34.25 per barrel, produced a deficiency of 171.25 pounds in the fermentable matter it contained; deducting, therefore, that sum from nine hundred and nineteen pounds, the aggregate of the extract of both malt and hops, I found that 747.75 pounds were all that could be expected to remain in the wort, at a fermentable temperature, *i. e.* when it had undergone the whole process, fermentation only excepted.

On comparing this sum with the actual quantity of fermentable matter found in the wort (736.375 pounds) there appeared still a deficiency of rather more than ten pounds; which may be accounted for by the probable supposition that there might have remained a small quantity of wort in the hops, at the time they were returned into the copper, which would have drained out, had they remained a little longer in the hop-back. Eleven gallons more would have effected the required balance; and this, I presume, is as near an approach to scrupulous accuracy as is consistent with the regular dispatch of real business.

My second wort having boiled its allotted time with hops from the first, I perceived that the 29.4 barrels at 17.6 were evaporated to twenty-two barrels, and its specific gravity was increased to 25.5 pounds per barrel. Multiplying these together, the product (five hundred and sixty-one pounds) shewed that there was an addition made to the fermentable matter of the simple extract, amounting to

43.6

43.6 pounds. To discover how this could happen, I considered that to the 517.4 pounds first extracted, the hops carried with them, from the first wort, 171.25 pounds, which I found they had imbibed, making in the whole 688.65 pounds; but as they still retained five barrels, the amount of the quantity first imbibed, I considered that the five barrels then imbibed, having displaced the former five, were only to be estimated at the rate of the specific gravity of the displacing wort; which being only 25.5 pounds per barrel, by multiplying that sum by five, I discovered the amount of the fermentable matter then remaining in the hops to be 127.5 pounds; which, deducted from the gross aggregate, 688.65, shewed that the sum of the fermentable matter at that time in the wort should have been 561.15 pounds; and as the actual quantity appeared five hundred and sixty-one, the accuracy of this calculation is confirmed to a degree of nicety hardly to be expected on so practical an occasion.

Submitting to a similar process my third wort, the original quantity of 30.26 barrels at 9.25, was reduced to 20.5, at 16.5 pounds per barrel. These multiplied together shewed the sum of the fermentable matter to be 338.25 pounds, which exceeded that of the simple extract (279.9 pounds) to the amount of 58.35 pounds. Pursuing the same mode of investigation, I added the 127.5 pounds, brought into this wort by the hops from the last, to 279.9, the fermentable matter extracted, and the sum of them both was 407.4 pounds. Then deducting therefrom 82.5 pounds, the amount of the fermentable matter contained in the five barrels of this wort retained, at 16.5 (the same quantity of the second having been displaced thereby, as before) I found that the sum of the fermentable matter of the whole wort should have been 324.9 pounds, but in the actual produce (338.25) I found an excess of more than 13 pounds, amply supplying the deficiency of the first wort; a circumstance probably occasioned (as was before suggested) by a want of that time to drain from the hops, which the last wort can always be allowed.

To

To render this business the more familiar, I will recapitulate, and bring the whole into one point of view.

1. *Fermentable Matter extracted from Twenty-four Quarters of Malt.*

					Pounds.
First wort,	31.47	barrels, at	28.5	pounds per barrel,	889.0
Second, —	29.4	— —	17.6	— — —	517.4
Third, —	30.26	— —	9.25	— — —	279.9
Total,	91.13	barrels, at	18.52	pounds per barrel,	1686.3

2. *Fermentable Matter remaining after boiling the Worts, including the Extract of Hops.*

					Pounds.
First wort,	21.5	barrels, at	34.25	pounds per barrel,	736.37
Second, —	22.0	— —	25.5	— — —	561.00
Third, —	20.5	— —	16.5	— — —	338.25
Total,	64.0	barrels, at	25.55	pounds per barrel,	1635.62

3. *Calculation*

3. *Calculation of the Fermentable Matter which ought to have remained, according to the preceding Doctrine.*

	Pounds.	*Pounds.*
First wort, produce — — — —	889.0	
Add, extract from 300 pounds of hops —	30.0	
	919.0	
Deduct, for 5 barrels, at 34.25, imbibed by the hops — — — — —	171.25	
Net remainder,		747.75
Second wort, produce — — —	517.4	
Add, fermentable matter brought in with the hops from the first wort — —	171.25	
	688.65	
Deduct, for 5 barrels, at 25.5, having displaced those first imbibed — — —	127.5	
Net remainder,		561.15
Third wort, produce — — —	279.9	
Add, fermentable matter brought in with the hops from the second wort — —	127.5	
	407.4	
Deduct, for 5 barrels, at 16.5, having displaced those imbibed of the second — —	82.5	
Net remainder,		324.9
	Total,	1633.8

4. *Correspondence*

Correspondence between the First and Final States of the aggregate Fermentable Matter extracted.

First State.	*Pounds.*
Sum of the extract from 24 quarters of malt contained in 91.13 barrels of raw wort — — — —	1686.3
Extract from 300 pounds of hops — — —	30.0
Total,	1816.3

Final State.	
Sum of fermentable matter contained in 64 barrels of wort in a fermentable state — — —	1635.62
Imbibed by, and remaining in the hops, per calculation	82.5
Total,	1718.12

By the foregoing state of the dissoluble parts of the malt and hops employed in brewing, we perceive, that however the bulk of their containing vehicle be changed, or their local or relative situation varied, the sum or quantum first extracted remains exactly the same, so far as we can discover by the means made use of for ascertaining it. And that those means are accurate may be readily inferred from the consideration that the difference between the actual and the calculated produce of the twenty-four quarters of malt above quoted, does not amount to two pounds in the sum of one thousand six hundred and thirty-five; a degree of accuracy to which general practice can hardly expect to attain.

In the course of my own practice, I must acknowledge, the correspondence, as above stated, has not always been so very accurate, the cause of which will be intimated in the succeeding section; but I am bold to affirm, that the result of my processes, through a long and continued adoption of this system, has so generally tallied with the principles therein inculcated, as to establish and confirm the truth of them, beyond a shadow of doubt.

Having thus taken a general comparative view of the fermentable matter, in its origin and in the period of its entrance into a state of partial annihilation, in the gyle tun, I come now to the particulars of its progress.

Of the Application of the Instrument during the boiling of the Wort, in order to REGULATE THE LENGTH, *or produce the Specific Gravity intended.*

THE irregularity and inequality of the produce of the same quantity of wort having been matter of frequent observation, I determined to enter into an investigation of that business, with the view of establishing the means of its prevention, on the sure basis of practice and experience.

At the time, therefore, that the first wort was going to be turned out of the copper, I took a quantity, filled an assay jar, and covering it close, to prevent evaporation, suffered it to cool. I then tried its specific gravity, and found it to be 31.76 pounds per barrel. Dividing this sum in 736.37, the amount of the fermentable matter remaining in

in the wort, after the absorption of the hops had taken place, the quotient 23.18, expressed the number of barrels of wort in the copper, at the period above-mentioned. The quantity of the cold wort, 21.5 barrels, being deducted from this, the remainder, 1.68, shewed the amount of the evaporation, or the quantity of wort evaporated, in passing from the copper to the cooler, including its continuance therein.

Proceeding in the same manner with the second wort, I found its specific gravity, at the period above indicated, to be 23.46 pounds per barrel; which being divided in 561, the final aggregate fermentable matter contained in the wort, the quotient was 23.91 barrels, being the quantity of wort then in the copper. Deducting from this the quantity of the cold wort, twenty-two barrels, the amount of the evaporation appeared, by the difference, to be 1.91 barrel.

The third wort having undergone a similar process, its specific gravity proved to be 14.92 pounds per barrel; which being in like manner divided in 338.25, its aggregate fermentable matter, the quotient, or quantity of worts in the copper, at the above quoted period, was 22.66 barrels; from which having deducted 20.5 barrels, the quantum of the cold wort, the difference shewed the amount of the evaporation to have been 2.16 barrels.

In order to make a general application of these discoveries, I compared the three evaporations together, and found their relative proportions to differ considerably, as will appear from the subsequent view of them.

The first wort of 21.5 barrels, at 34.25 pounds per barrel, had evaporated 1.68 barrel, which is in the ratio of 7.7 per cent.

The second, of twenty-two barrels, at 25.5 per barrel, had suffered the greater evaporation of 1.91 barrel, or to the amount of 8.65 per cent.

The third, of 20.5 barrels, at 16.5 per barrel, had evaporated so much as 2.16 barrels, or 10.5 per cent.

This comparative view suggested to me the idea, that worts of different densities evaporate in different proportions, *ceteris paribus*, and determined me to proceed in such enquiries on the subject as, being the result of present experience, should become the rule and standard of future practice, without having recourse to the minutiæ of philosophical disquisition, which the rude magnitude of my útensils rendered inadmissible or inefficient.

From a long and tedious course of experiments, which, I must candidly acknowledge, did not always exactly correspond with each other, I have been enabled to form the *table of evaporation* which accompanies the instrument, with those before-mentioned, and which, I have no doubt, will answer the intention of the practitioner; having been formed with all the accuracy and precision of which the nature of the business would admit, and which a continued application of it, in my own practice, has sufficiently confirmed.

That these experiments have not been attended with all that correspondent exactitude which philosophical precision requires, is not to be wondered at, when we consider the dispatch necessary in actual business, and the unavoidable irregularity of those dimensions on which our calculations must necessarily be founded.

In the first place, if the guage of the under-back be not very correct, and its contents always dipped with the greatest nicety, the quantity of wort, and, of course, the sum of its fermentable matter, must

must be wrong, and all calculations arising therefrom must be erroneous *ab origine.*

Secondly, if the quantity in the under-back be perfectly ascertained, and the assay jar, containing a specimen of the wort, be imperfectly or not at all covered, as there will be, in that case, an evaporation from the latter, * which does not take place, and therefore is not accounted for in the former, the real gravity of the wort, calculated from its condensation only, will be wrong represented by it, and consequently cause another error in the sum of the fermentable matter produced.

Thirdly, supposing these particulars to have been attended to, with all imaginable care, the correspondence between the actual and the calculated aggregate of the fermentable matter may not be correct, from the unavoidable retention of a part of the wort in the pump, which conveys it from the under-back to the copper; from some small quantity which may remain in the latter, intermixed with the few hops which will generally be left at the bottom; from the want of time for the whole of the wort to be effectually drained from the hops; and from a quantity of wort which may, and frequently does, remain in the hop-back, retained by the irregularity of the bottom, the seeds and such parts of the hops as have passed through the false bottom, or by the back itself not being set with a proper current towards the part where it discharges the wort into the cooler.

Fourthly, should none of these obstacles intervene (which can scarcely happen) the several proportions of the whole volume, which worts

* From some cursory observations made on this subject, it appears that the difference between a covered and an uncovered jar, is about 0.75 per cent. in a wort of thirty pounds per barrel and upwards; above one per cent. in a wort of half that density; and three per cent. in one of five pounds per barrel.

worts of different densities evaporate, may not always correspond, with philosophical accuracy, to the notations in the table; because the exposure of a larger surface will produce a more copious evaporation in a wort of equal volume and density, than that of a less; and even a strong current of air passing over it, will have a similar effect, by ruffling the surface, and thereby carrying off a larger portion of the aqueous particles than would have escaped, had it remained in a state of quietude. From a few observations made upon the difference of effect produced by the different evaporations of the same wort in an assay jar and in the cooler, it appears that the latter, in many cases, increases the gravity two pounds per barrel.

Lastly, the difficulty of ascertaining the exact quantity of wort, and consequently of making an accurate calculation of the fermentable matter it contains, by taking a guage in the coolers, is not the least of the obstacles to be encountered in this business. In large utensils, where a volume of twenty barrels of wort does not, perhaps, lie more than an inch deep in the cooler, without particular care, there is a hazard of making an erroneous estimate of one to two barrels in that quantity, by dipping, or taking the depth only; for if the rule or guage made use of be perfectly dry, and the wort cold, as it should be at the time of taking the guage, the surface will bend, as it were, inwards, following the immersion of the rule, so as to make a visible concavity round it; and if taken out then, the part wet with the wort will sometimes be near one-tenth of an inch less than its real depth. On the contrary, if the rule be moist, the wort, attracted by the moisture, will ascend upon the rule as much above the level of its surface, as, in the former case, it was below it.

A due attention having been paid to these several particulars, in forming the *Table of Evaporation*, I have no doubt but its judicious application will ensure to the practitioner the desired success.

To apply it, in practice, we must invert, in some degree, the experiments on which it is founded, and by laying down its proportions as certain data, then proceed to the calculation of the specific gravity finally required. For instance, had it been required to produce from the first wort, in the foregoing example, a length productive of the final specific gravity of thirty-four pounds per barrel, we must have proceeded to calculate the specific gravity it ought to have, at the point of being turned out of the copper, and by occasionally taking out a specimen, cooling, and trying it, during the boiling (in the manner hereafter particularized) we should have been able to have turned it out in that exact state which would have produced the desired effect. The calculation is thus made :

	Pounds.
31.47 Barrels of wort in the under-back, at 28.5 pounds per barrel — — — — — — —	889
Extract of 300 pounds of hops — — — —	30
	919
Deduct for 5 barrels of wort imbibed by the hops, at 34 pounds per barrel — — — — —	170
Net fermentable matter remaining — — — —	749

	Barrels.
Then divide 749 by 34, the gravity to be produced, and the quotient will be the final quantity of the wort at that specific gravity, *viz.* — — — — —	22.0
Add the amount of the evaporation, in the proportion of 7.6 per cent. *, which on 22 barrels is — — — —	1.67
Total —	23.67

* This is the proportion which a wort of thirty-four pounds per barrel will have evaporated, according to the *Table of Evaporation*; therefore, as 100 is to 7.6, so is 22 to 1.67, as above stated.

Which is the quantity of wort in the copper, at the time of its being turned out. This divided in 749 pounds, the net sum of fermentable matter, gives 31.64 pounds, indicating the specific gravity the wort ought to have had at the above-mentioned period, in order to have produced thirty-four pounds per barrel in the cooler.

This rule is general, and may be applied to all lengths, adopting only the proportion indicated in the *Table of Evaporation*, as corresponding with the specific gravity intended, instead of the proportion here adduced.

As there may be some, however, who may wish to avoid all calculation, as much as possible, and who might prefer a rough system and random principle, if calculated to save time, and come near enough the truth for general practice, I endeavoured, from a comparative view of my continued experiments hereon, to accommodate those of this description with something in their own way. For having observed, in the example before us, that my first wort gained 2.49 pounds per barrel in gravity, by its evaporation from the copper to the gyle-tun; that my second gained 2.04 pounds by the same means; and that my third increased only 1.58 pound, from a similar cause, I immediately concluded, that certain principles might be established for the purposes above alluded to, sufficiently satisfactory for the mere man of business; and accordingly, after duly digesting the several results of my own long practice, I sketched out the *Table of the Increase of the Gravity of the Wort, occasioned by Evaporation in the Cooler;* by the adoption of which, the careful practitioner will not be subject to an error of more than a small part of a pound per barrel, in his intended gravity. In case of this adoption, nothing more is necessary than to deduct from the intended specific gravity, the corresponding increase of gravity in the table, and the remainder will be that specific gravity the wort ought to have when turned out of the copper. For instance, in the table against 34, is the sum 2.40, as indicating the increase

increase of gravity, which being deducted from 34, the gravity intended, the remainder, 31.6, shews the specific gravity of the wort in the copper, which is only a difference of 0.16 less than that indicated by the more accurate calculation of the table before recommended. *

In order the more expeditiously to cool the specimen of wort taken out of the copper, for the purpose of noting its specific gravity, I caused to be made the *refrigerator*, already described, the application and use of which being hereafter particularly treated of, I shall proceed to the consideration of the wort in the coolers, preparatory to its being submitted to the action of fermentation.

Of forming AVERAGE GRAVITIES, *in order to produce the certain Foundation of* UNIFORM STRENGTH.

THE first wort, in the above-quoted example, being cool, I took the guage and specimen, and found the quantity and gravity to be as before-mentioned. Had this been fermented alone, this simple process would have been sufficient to have indicated its quantity and quality ; but as other worts were to be added to it, my experiment thereon was not final. I, therefore, proceeded in like manner with the second wort, and making a supposition that these two only were to

* Since writing this article, the table has been collated with, and corrected by, the Table of Evaporation, so that it may be adopted with as great accuracy as actual practice can attain to, as will hereafter appear.

to be fermented together, I demanded the average gravity of the commixture. To solve this, I added 736.37 pounds, the net fermentable matter of the first, to 561, the net fermentable matter of the second, the sum of which was 1297.37 pounds.—I then added 21.5 barrels, the quantity of the first, to 22 barrels, the quantity of the second, and dividing their sum (43.5) in 1297.37, the sum of the fermentable matter, the quotient, 29.82, shewed the average specific gravity required.

In like manner I added together several net aggregates of the fermentable matter of all the three worts, the sum of which, 1635.62 pounds, being divided by 64 barrels, the sum of their several quantities, I found that 25.55 pounds per barrel (the quotient) was the average specific gravity of the whole gyle.

To have considered either of these averages as a standard, and to have endeavoured to produce it accordingly, I must have recurred to some of my former calculations on this subject. In the first case, supposing it to have been intended that the two first worts should have been fermented together, and that 29.82 pounds per barrel was the average gravity required, I should have suffered the first wort to have been boiled its appointed time, without having examined its gravity till in a proper state in the cooler; having then found it to be 34.25 pounds per barrel, I should have proceeded to consider how far the second wort of 29.4 barrels, at 17.6 pounds per barrel (at that time in the copper) should be evaporated, so as to have produced the average intended. For this purpose, I should have made a supposititious estimate that the two worts would be finally of equal quantities, and thence multiplying 29.82, the required average, by 2, and from the product 59.64, deducting the gravity of the first wort 34.25, I should have discovered that 25.39, the remainder, was the required gravity of the second wort; but the quantity of both worts not being equal, this

this gravity is supposititious, serving only to estimate therefrom the amount of the fermentable matter imbibed by the hops, in order to ascertain the net remainder, preparatory to the calculation of the true specific gravity required; whence, according to the manner just inculcated, I should have proceeded to have calculated the gravity it ought to have on being turned out of the copper, finally to produce that required gravity.

	Pounds.
In the under-back 29.4 barrels, at 17.6 — — —	517.4
Add, Sum brought in by 5 barrels of the first wort remaining in the hops, at 34.25 — — — —	171.25
	688.65
Deduct, Sum retained by the hops with 5 barrels of this wort, calculated at 25.39 — — — —	126.95
Add, Net aggregate of the first wort — — —	561.70
Apparent net aggregate — — —	736.37
Total —	1298.07

This sum being divided by the required average, 29.82, the quotient 43.53, is the number of barrels of which the two combined worts are to consist; deducting from this 21.5, the number of barrels in the first wort, the remainder 22.03, is the final number of barrels in the second; which number divided in 561.7, its apparent net aggregate of fermentable matter, shews the required final gravity of the second wort to be 25.49 pounds per barrel.

Then

		Barrels.
Then, to the final quantity of wort in the cooler	— —	22.03
Add, the amount of the evaporation, in the proportion of 8.7 per cent. (as per table) which on 22.03 barrels is		1.91
And the total quantity of wort, at the time of being turned out of the copper, is	— — — —	23.94

Dividing this in 561.7, the apparent net aggregate, shews the specific gravity of the wort in the copper to be 23.46 pounds per barrel. Or, pursuing the short method before-mentioned, the calculation would have run thus :

		Pounds.
Specific gravity required	— — — —	25.49
Deduct, increase of gravity by evaporation	— —	2.06
Gravity of the wort in the copper	— — —	23.43

The difference in these two calculations, respecting the gravity of the wort in the copper, being only 0.03 per barrel, it is a natural inference that for general practice, the latter, unscientific as it appears, will be preferred, for the sake of ease and expedition.

I come now to the real state of the brewing before us, *i. e.* the three worts being intended to produce one uniform liquor, by being blended and fermented together, my attention was directed to the certain means of producing the average gravity required for the whole gyle, on the principles here laid down.

Premising

Premising that 25.55 pounds per barrel was the average gravity, I paid no regard to the gravity of the two first worts in the copper, but suffering them to boil their proper time, I made the necessary experiments on them in the coolers, and, according to the calculation just adduced, found their average gravity to be 29.82, as before-mentioned. This I considered as the average of two-thirds of my whole length, and that the last wort was of course to supply the remaining one-third. I therefore multiplied 25.55, the required average gravity, by 3, the number of the worts, and the product was 76.65; from which deducting 59.64, the product of the average gravity of the two first worts, multiplied by their number, 2, and the remainder 17.01, shewed the suppositious gravity of the third wort, on a presumption of its quantity being the one-third part of the whole.

I then pursued my former method of calculation to find out its true final specific gravity, and thence to deduce the gravity it ought to have in the copper, in order to produce the said final specific gravity in the cooler, *viz.*

	Pounds.
In the under-back 30.26 barrels, at 9.25 — =	279.9
Brought in by 5 barrels of the second wort remaining in the hops, at 25.5 — — — —	127.5
	407.4
Retained by the hops, with 5 barrels of this wort, calculated at 17.01 --- --- --- --- --- ---	85.05
Apparent net aggregate --- ---	322.35
Add, net aggregate of the two former worts --- ---	1297.37
Total ---	1619.72

Which

Which total divided by 25.55, the required average gravity, shews 63.4 to be the number of barrels contained in the whole three worts; from which deduct 43.5, the contents of the first and second, and the remainder 19.9, is the final number of barrels in the third wort; which number being divided in its net fermentable matter 322.35, gives 16.2 pounds, the true specific gravity required.

	Barrels.
Then, to the final quantity of the wort in the cooler ---	19.9
Add, the evaporation (as per table) of 10.5 per cent. which on 19.9 is --- --- --- --- --- ---	2.08
And the total quantity of wort, at the time of being turned out of the copper, is --- --- --- --- ---	21.98

Which sum being divided in 322.35, the net fermentable matter, indicates the specific gravity of the wort in the copper, as above, to be 14.66 per barrel; which, by the short system before referred to, would have appeared thus:

	Pounds.
Specific gravity required --- --- ---- ---	16.2
Deduct, increase of gravity by evaporation --- ---	1.57
Gravity of the wort in the copper --- --- ---	14.63

This again exhibits an erroneous difference of 0.03 per barrel, from the former calculation; and this difference, as I have before suggested, will most probably be dispensed with, in the hurry of business, for the sake of the dispatch necessary in the general process of brewing; nor, indeed, is a nearer approach to mathematical certainty to be generally

generally expected, in a business conducted on so large a scale as that of the brewery, for reasons before explained. *

Had two of these worts been boiled together, a practice sometimes adopted, nothing more would have been necessary than to have multiplied the quantity of each by its gravity, and by adding the product of both together, to have considered their sum as the contents of one wort, and to have proceeded as above indicated, for the production of the gravity required.

If we compare the result of these calculations with the actual state of the several worts, we shall find a little variation, which is not to be avoided. According to the real products of the first and second worts, their average gravity, as above shewn, was 29.82 pounds per barrel, the second being 22 barrels at 25.5 ; but, by my mode of calculation, the latter being 22.03 barrels at 25.49, the former consequently appeared 29.79 pounds per barrel. In like manner, the real aggregate quantity of the three worts was 64 barrels, whose average gravity was 25.55 pounds per barrel, whilst the calculated quantity was only 63.4 barrels at 25.54 pounds per barrel.

The cause of this small difference (exclusive of the irregular draining of the wort, before treated of) exists in the impracticability of previously assertaining the precise quantity of fermentable matter finally contained in the latter wort, which alone is to fill up the measure of the calculation, and produce the required average. For instance, I knew that my third wort contained 279.9 pounds of fermentable matter ; I knew also that 5 barrels of the second wort, brought into this by the hops, made an addition thereto of 127.5 pounds ; and that the then gross aggregate of fermentable matter was of course 407.4 pounds. Could this have remained entire, the calculation

* Vide preceding Note.

culation would have been simple, and the average certain; but as I was convinced that the 5 barrels of wort thus brought in, would only be displaced by as much of the present wort, so that 5 barrels of this would still be retained by the hops; and as it was indispensible that its specific gravity, at the time of this retention should be ascertained, in order to discover what portion of the fermentable matter would be retained therewith, and, of course, what would remain to be added to that of the preceding worts, I had no other means of obtaining this information, than by establishing a supposition that the wort in question must be, when in the cooler, equal in quantity to one-half of two worts, or to one-third of three; and that its final specific gravity must consequently be deduced from a supposititious gravity founded on those proportions.

Thus, in the example before us, I was under the necessity of supposing the quantity of my last wort to be finally equal to one-third part of the whole, and as its gross contents were 407.4 pounds, I thence calculated the supposititious gravity of 17.01 pounds per barrel, which reduced the supposed one-third to 0.6 barrel less than it afterwards appeared to be; yet as this uncertain principle has only relation to the quantity imbibed and retained by the hops, it has so little effect upon the general average, respecting either quantity or quality, as scarcely to merit notice; especially as the general practice of the brewery aims at producing the worts as equal in quantity as possible.

These rules and observations having, I presume, sufficiently explained the means of ascertaining average gravities, I shall now proceed to point out the end and purpose of their establishment.

The

The Utility of establishing a STANDARD GRAVITY, *as conducive to the forming therefrom an Estimate of the* VALUE OF BEERS *of different Qualities.*

WERE it in the power of the brewer to dispose of his liquor at a price proportioned to the quantity of malt employed, or rather, according to the portion of fermentable matter it contains, estimated from the price of the malt itself, the application of the instrument, as above directed, would immediately lead to the value of beers of every strength, deduced by the simplest calculation, from their average specific gravities only; but since almost every situation has its established price and strength, which being entirely local, have no reference or relation to the price or qualities of the beers of other places, nor are scarcely ever to be regulated by the cost of the materials themselves, it will be necessary to estimate the local value of beers of different qualities, by the relative proportion which the standard gravity of the wort bears to the obtainable price of the liquor which experience has shown to be producible from that standard. Thus, if it were required to brew beer of a different quality, to accommodate different consumers, the required strength being once known, we have then to calculate, from the general standard gravity, the price at which it should be sold, in order to be proportionably beneficial with the sale of the standard liquor; or, the price being limited, we have in that case to discover what strength must be produced for that price, to be beneficial in a like relative proportion. For instance, supposing twenty-five pounds per barrel to be the general standard alluded to, and that the beer produced from it sold for twenty-five shillings per barrel, clear of the duty, which should not be included, it is an obvious inference that the product of any other gravity would be proportionably advantageous, if sold at the rate of one shilling per barrel for every pound of fermentable matter it previously contained.

 Hence,

Hence, if forty pounds per barrel were the required gravity, the price ought to be forty shillings, exclusive of the duty; or if the obtainable price were limited to thirty-six shillings, or any other specific sum, the proportionate gravity or strength would be thirty-six pounds per barrel, or such other gravity as should be correspondent to the specific price. In like manner, were the same standard to be estimsted at a different rate, a similar proportion must take place. Thus, premising the standard price to be but twenty-three shillings per barrel, exclusive of the duty, we should say, for a required gravity of forty pounds per barrel, as twenty-five pounds, the standard gravity, is to twenty-three shillings, the standard price, so is forty pounds, the required gravity, to 36.8 shillings per barrel, the required proportionate price. Or, in the instance of the price being given, supposing it to be thirty-six shillings per barrel, we should then say, as twenty-three shillings, the standard price, is to twenty-five pounds, the standard gravity, so is thirty-six shillings, the given price, to 39.13 pounds per barrel *, the required proportionate gravity.

The propriety and utility of these calculations will be obvious to every one who is occasionally engaged in the production of strong beers intended to bear different prices; and even in that of small and table beer, they will not be undeserving of attention.

According to our first ratio, we should learn, that if we suffered our small beer to be of a gravity exceeding six pounds per barrel, when sold at the price enjoined by law, it would be a less advantageous branch than that of strong; and were a table-beer to be demanded, we could immediately calculate the gravity it ought to have, as above inculcated, proportioned to the price we should obtain for it; and that with a degree of precision to which the usual vague mode

* It may be superfluous to remark, that the specific gravity every where mentioned in this article, is that of the wort in the cooler, at a fermentable temperature.

mode of estimating so many barrels per quarter, can in no wise bear a comparison, and which must totally put to shame that more vague and barbarous appeal to the palate, authorized by the board of excise, or assumed by its officers, in characterizing or determining the quality of worts, as a rule for their conduct in the charge of the duties; or rather, as a means of detecting frauds, and of preventing impositions upon the revenue.

Of the Attenuation of fermentable Matter, or an Attempt to ascertain the STRENGTH OF MALT LIQUORS, *by a comparative View of their specific Gravities, prior and posterior to the Action of Fermentation.*

In order to ascertain how far the apparent *strength*, or the *inebriating quality*, of beers, fairly produced by fermentation, had a relation to the quantity of fermentable matter attenuated by that action, I proceeded to examine several different kinds of malt liquor, whose previous, or average, gravity had been duly noted, and the result of that enquiry was as follows:

STRONG ALE.

No.	Gravity of the Wort in a fermentable State.	Gravity of the Beer when transparent.	Gravity lost; or Amount of the fermentable Matter attenuated.
1	—42.0—	—18.6—	—23.4—
2	—41.7—	—22.5—	—19.2—
3	—41.0—	—20.8—	—20.2—
4	—40.6—	—18.1—	—22.5—
5	—40.0—	—21.6—	—18.4—
6	—39.0—	—18.5—	—20.5—
7	—38.3—	—17.8—	—20.5—
8	—36.7—	—17.2—	—19.5—
9	—36.0—	—12.5—	—23.5—

COMMON ALE.

1	—32.3—	—13.9—	—18.4—
2	—28.0—	— 5.1—	—22.9—
3	—27.7—	— 6.9—	—20.8—
4	—27.0—	— 8.5—	—18.5—
5	—25.2—	—11.5—	—13.7—
6	—24.4—	— 9.7—	—14.7—
7	—23.5—	— 7.6—	—15.9—

PORTER.

1	—29.5—	— 8.3—	—21.2—
2	—26.0—	— 6.5—	—19.5—
3	—25.5—	— 6.0—	—19.5—
4	—24.5—	— 6.5—	—18.0—
5	—23.3—	— 5.3—	—18.0—

TABLE BEER.

1	—19.4—	— 7.5—	—11.9—
2	— 9.4—	— 2.7—	— 6.7—

On

On taking a comparative view of these specimens, and observing that the amount of the attenuation did by no means correspond with the original gravity, or that different worts were not attenuated in proportion to their respective gravities, I was led to conclude, that all my former conjectures on this subject were erroneous; especially when I considered that two liquors equally attenuated, though originally of very different gravities, had apparent strength, or inebriating effects more nearly proportioned to their gravities, than to the amount of the attenuation.

To be assured of this, I put one beer gallon of the *strong ale*, No. 5, into a small still, and having drawn over one wine-quart (before the completion of which, the liquor which came over had, for some time, been mere water) I found, by experiment, that the strength of the liquor thus distilled, was 36.4 parts of 100 proof spirit; or, that the composition consisted of 36.4 equal parts of proof spirit, and 63.6 of water. Then saying if one gallon of ale produce 0.361 quart of proof spirit, 36 gallons will produce 13.1 quarts; by which I discovered, that an attenuation of fermentable matter to the amount of 18.4 pounds per barrel, produces 13.1 quarts, wine measure, of proof spirit.

I then took one gallon of the weakest *porter* (No. 5) the amount of whose attenuation was 18 pounds per barrel, and distilling, in like manner, one wine-quart, its strength appeared to be 37.3 parts of 100 proof spirit, which was in the proportion of 13.4 quarts per barrel. So that, in this experiment, the attenuation of 18 pounds per barrel, produced 13.4 quarts of proof spirit; a quantity rather exceeding that of the former experiment, though the attenuation was somewhat less; which I am inclined to attribute to some little difference in the accuracy of conducting them; the former having boiled over at first, which might occasion some loss of spirit, though the liquor thus thrown over was carefully returned into the still.

Several

Several other distillations which I made, with various success, served to convince me, that though the quantity of spirit produced did not, in my experiments, exactly correspond with the amount of the attenuation, in the ratio above quoted, yet the relation between them was sufficiently near to warrant my opinion, that, by a distillation conducted on a larger scale, and with measures more philosophically correct, it will be found, that every pound of fermentable matter attenuated by the action of fermentation, will produce the same quantity of proof spirit, by distillation, whether the attenuation has been effected in a strong wort of forty, or a weak one of ten pounds per barrel.

My present experiments, which I must acknowledge to have been too imperfect and inaccurate to justify my founding a system upon them, do indeed tend to a suspicion that the attenuation of weaker worts, produces a somewhat greater portion of spirit than that of the stronger. Those which I have noted are the following:

No.	*Gravity of the Wort.*	*Attenuation.*	*Spirit produced.*
1	— 40.0 pounds.	— 18.4 pounds.	— 13.1 quarts.
2	— 23.3 —	— 18.0 —	— 13.4 —
3	— 25.2 —	— 13.7 —	— 11.6 —
4	— 19.4 —	— 11.9 —	— 9.7 —
5	— 9.4 —	— 6.7 —	— 6.5 —

Now if we establish the second experiment as a standard, (having been the best conducted) and calculate the proportionate quantity of spirit producible from the several attenuations of the other experiments, they will stand thus:

No.	*Gravity.*		*Attenuation.*		*Spirit produced.*		*Spirit producible in the ratio of the second Experiment.*	
1	40.0	pounds.	18.4	pounds.	13.1	pounds.	13.7	quarts.
2	23.3	—	18.0	—	13.4	—	13.4	—
3	25.2	—	13.7	—	11.6	—	10.2	—
4	19.4	—	11.9	—	9.7	—	8.9	—
5	9.4	—	6.7	—	6.5	—	5.0	—

From this view of the spirit actually produced, and the several proportions producible, according to calculations made from the quantity obtained by a very accurate experiment, it is evident that there is a correspondent relation between the portion of fermentable matter attenuated, and the spirit produced by fermentation, entirely independent of the original gravity of the wort, or the apparent strength of the beer, though that relation, as not immediately necessary to my purpose, I have not as yet had leisure to examine, with that accuracy and precision requisite to establish so novel a discovery.

In the investigation of this subject there is, however, a circumstance presents itself to our consideration, of which I was not at first aware; and that is, the conviction, from these experiments, that *the apparent* STRENGTH *of malt-liquors, or that* INEBRIATING EFFECT *which they produce upon the animal frame, does not entirely consist of* SPIRIT.

To prove this, we need only advert to the experiments just noticed, where we shall see that ale so very strong as that produced from a gravity of forty pounds per barrel, yielded no more proof spirit (the produce being strictly less) than the weak porter in the second experiment, of 23.3 per barrel; though the same person, drinking an equal quantity of each, would have found their effects to have been powerful, rather in proportion to their respective gravities, than to the quantity of spirit producible from them. Indeed, if we consider the small portion of spirit contained in this strong ale; that it is not the

one

one twelfth part of the whole; and that yet this ale (of the Burton kind) would produce as potent an effect upon the drinker, as the same quantity of spirit and water, consisting of one fifth, or at least one sixth part of the former; we shall be convinced that there is another principle in malt-liquors (if not in all fermented liquors) besides that of *spirit,* which contributes to that inebriating quality to which common usage has affixed the name of *strength.*

If we suppose this strength, in the present case, to be equal to a commixture of spirit and water containing one sixth part of the former, we shall then find that this new principle is equal in effect to the quantity of its concomitant spirit; for supposing each to be one twelfth part, the sum of them both will be just equal to the quantity of real spirit in the commixture above-mentioned, as their effects are equal; and till we have a better clew to direct our judgment herein, than the sensibility of the palate, or the strength of the brain, we must be content with probable conjecture, and rational hypothesis for our guide.

The most natural supposition which occurs to me, on the present occasion, is, that the principle here alluded to is the *gas or fixed air,* produced by, and inherent in all fermented liquors, so long as they contain the least essential particle of their original composition, or of those constituent parts which form their value; and as the production of *inflammable spirit* is the criterion of vinous fermentation, and as that fermentation is always productive of the *fixed air* I am here treating of, it is a most probable conjecture that their production being concomitant, *ab initio,* so is their existence inseparable, so long as their last and least characteristic particle remains.

That they are thus constantly and inseparably attendant on each other, so long as the liquor which produced them merits our observation, may be easily demonstrated. Simple distillation proves the existence

existence of the *spirit*, and the least motion or close confinement of the liquor shews that of the *fixed air*, by its incessant attempts to escape. Beer newly drawn from the cask, or agitated in a glass after remaining in a state of quietude, having by either means the coherence of one particle to another disturbed, is deprived of a considerable portion of air, which is thence set at liberty, and its escape is visible to the eye. The same effect is observable after beer has been some time confined in a bottle, by which means the perpetual tendency of the air to escape is prevented; for no sooner is the cork drawn than the air rushes with impetuosity from every part, to the surface, where its escape is as sensible to the smell, as its progress thither is visible to the eye *.

Its existence, as air, cannot be more incontrovertibly proved; and that it flies off with, or rather before the spirit, in distillation, there is not less doubt. The smell discovers its avolation and escape before the spirit is sufficiently rarefied to rise; for being more volatile, it must, of necessity, come over first; and the vapidity and the nauseous flavour of the caput mortuum which remains, after the spirit is drawn off, seem to indicate that the fixed air has taken its flight with its companion, though the latter, only, is arrested in a palpable form.

Having thus demonstrated that fixed air is the constant attendant of the spirit produced in malt-liquors, it remains for us to endeavour to investigate the causes of its irregular produce, and to examine its claim to those effects which are ever consequent to that quality generally termed *strength*.

Though in the instance just now adduced, I have supposed the fixed air and the spirit to be equal, from observing their united effects

upon

* Air is so abundant in malt-liquors, that if a glass of it be set in the receiver of an air-pump, on exhausting the air out of the receiver, the air in the malt-liquor will rush out so violently as to convert the whole into a froth.

upon the drinker of the liquor which contained them, and from a comparison of similar effects produced by a liquor of definite strength, I do not thence mean to insinuate that they are always equal in quantity or effect, the contrary of which is evidently the case; for the different proportions of either can only result from accidents dependent on the previous strength or gravity of the wort, the mode of conducting the business of fermentation, and the manner of preserving the fermented liquor.

With respect to the former particular (the gravity of the wort) we shall be convinced of the inequality of the production of these two principles, by attending to the few experiments above noted. In the first and second we see the quantity of spirit actually produced was nearly equal, yet the gravities of the worts were different in a ratio of three to five, and the inebriating effects of the liquors, when fermented, were nearly different in a like proportion. Hence, taking it for granted that our first experiment contained fixed air equal in effect to the spirit which it produced, (*i. e.* one twelfth part of the whole) and establishing that as a standard, we can calculate the real strength or inebriating quality of the second, according to the proportion of its previous gravity, by saying, as 40, the gravity of the first, is to 23.3, the gravity of the second, so is 12, the supposed portion of fixed air in the first, to 7, the proportionate quantity of fixed air in the second. Then adding the spirit producible, according to the fermentable matter attenuated, to their respective portions of fixed air, the strength of the two liquors will stand thus:

First Experiment, from the Strong Ale, No. 5.

Spirit	—	—	12
Fixed air	—	—	12
Inebriating quality		—	24 parts of 144.*

* The number of quarts in a barrel.

Second Experiment, from the Porter, No. 5.

Spirit	—	—	12
Fixed air	—	—	7
Inebriating quality		—	19 parts of 144.

Hence we see that the inebriating quality of the second exceeded the proportion of its gravity, merely by an extra production of spirit, the consequence of a different mode of conducting the fermentation; for had the spirit produced been in the ratio of its gravity, the inebriating quality would have only been 14, instead of 19 parts of 144; for, as 40 is to 23.3, so is 24 to 14.

If we try the third experiment by the same rule of proportion, we shall find that it falls short of the second, though from a wort of superior gravity, from the same cause which operated in favour of the latter, in the production of the extra portion of spirit just mentioned. For example, as 40, the gravity of the first experiment, is to 25.2, the gravity of the third, so is 12, the supposed portion of fixed air in the first, to 7.5, the proportionate fixed air in the third. Then estimating the producible portion of spirit (10.2 wine quarts) at 9 quarts beer-measure, the strength of the beer will be thus estimated:

Third Experiment, from the Common Ale, No. 5.

Spirit	—	—	9
Fixed air	—	—	7.5
Inebriating quality		—	16.5 parts of 144.

Yet this, though it fell short of the strength gained in the second experiment, exceeded the ratio of the first; for, according to that proportion, it would have been little more than 15.

 We

We are hence led to the consideration of the second operating principle in this business, *i. e.* the mode of conducting the fermentation, which has a very considerable influence on the production of both the fixed air and the spirit.

In the first experiment, the great strength or density of the wort requiring a greater force in the fermenting principle than was admissible in that particular practice, was to be productive of the qualities required in that particular liquor *; the portion of spirit was of course less than it might have been, if a stronger ferment could have been consistently adopted. On the contrary, the second experiment having had all auxiliary force which can be applied to a fermentation intended to produce a potable vinous liquor, the attenuation of the fermentable matter exceeded three-fourths of the whole, whilst that of the first did not proceed much further than nine-twentieths; the consequence of which was, that an extra-quantity of spirit was observable in the second. And that the quantity of fixed air in the latter was not equal to that of the former may be attributed to the extraordinary force of the fermentation, which carried off a great portion of it during its action; for it is not to be doubted that fermentation, conducted in a certain powerful manner, and carried to a certain length, will so far deprive the liquor of its fixed air as to render it scarcely discernible. It may, therefore, be established as a principle, that *the quantity of spirit produced by an imperfect fermentation is less than its fixed air; and that a fermentation carried to its utmost length, dissipates its fixed air in proportion as it increases its quantity of spirit.*

A corroborating circumstance, in support of this principle, occurs in the deficiency of yeast, observable in consequence of an imperfect fermentation; for as wort abounds in dormant, inactive air, inveloped in the fermentable matter, it is no sooner put into action than it seeks

to

* Ale, of the Burton kind.

to disentangle itself, and in its escape becomes a doubly operative principle, *viz.* generative, in the production of spirit; and excretory, in the separation of mucilaginous parts of the fermentable matter, which assumes the form of yeast; whence the more it is dissipated, the greater is its produce in these two articles, and *vice versa.*

The last particular which engages our attention, on this occasion, is the effects resulting from the manner of preserving the liquor. That this has an influence on the apparent strength will be generally acknowledged; but whether it is to be ascribed to an additional production of spirit, or to an increase of fixed air, or to a participation of both, I cannot take upon me to demonstrate, not having yet had opportunity to apply the still to the same liquor, at different periods, and in different modes of its preservation. I am, nevertheless, inclined to the opinion, that the generation of the fixed air, as more obvious to the senses, is the more probable cause of that difference in strength distinguishable in malt-liquors kept in bottles, though I do not mean to insinuate that there is not a similar addition to the spirit, when kept in casks, nor a partial addition of each in both cases. What I wish to demonstrate is, the certainty of the fact, that fixed air is generated posterior to the completion of vinous fermentation; after the liquor is become potable; and even after accident or negligence has destroyed some of its most valuable qualities, and rendered it unfit for use.

It is well known that during fermentation, the production of the fixed air is so adundant, that were not means provided for its escape, the strongest vessels could not contain it; and as the force of that action abates, the avolation of the air proportionably decreases, so that when the liquor is in a quiescent state, the escape of the air is not perceptible. Yet after the cask is closed, and it finds no other vent than through the pores of the wood, we frequently perceive it collected in such force as to rush out with great violence so soon as an

aperture

aperture is made in the cask, and even to force a considerable quantity of liquor with it, to the height of five or six feet.

The same effect is observable on a change of the temperature of the external air, from cold to warmer, and that after the liquor has been for some months apparently quiet; for in this case, the fixed air being rarefied, escapes in greater quantity, and produces effects similar to those just described.

A further proof of the continual production of this air, is the *recovery* and *melioration* of beers which have been quite vapid and undrinkable, by the simple operation of bottling only. The cause of vapidity being nothing more than the total escape of the fixed air at that time generated, and the beer being thus deprived of its vital principle, can recover by no other means than those of an effectual prevention of all further escape, till such a portion of fixed air is again generated as will supply the place of that which is lost. In that case, bottling is the most efficacious remedy, particularly if the bottles are placed in a temperature somewhat warmer than that wherein the cask was from which it was drawn. By this means the liquor, being still generative of fixed air, is again replenished with it, which effects its *recovery*; and that generative principle continuing still active, the air becomes abundant (all escape being prevented) which is productive of *ripeness*, commonly so termed, or that *melioration* above alluded to.

It now remains for us to endeavour to fix some criterion by which we may be assured that the fixed air thus generated, is a component part of the strength of fermented liquors. In this, having unfortunately no better guide to direct our enquiries than the vague discrimination of the senses, we must be content to reason from analogy, till some further chemical analysis shall lay a foundation capable of supporting a system established in mathematical certainty.

A judgment

A judgment may be formed on this subject, by comparing the different effects of equal quantities of the same beer, one part taken from the cask, when it is in a quiet state, and the other from a bottle, when ripe and full of fixed air; in which case, the apparent strength of the latter will be found so far to exceed that of the former, as scarcely to need any other argument in favour of the air we are treating of.

Of the powerful influence which this, as an inebriating principle, has upon the animal frame, I can speak from experience, and perhaps no instance is more strongly in point than the following: upon some exhausted refuse raisins, from which wine had been just made, I poured some water, and after it had remained on them a short time, I let it drain off, when it was so slightly tinctured, as to render it a matter of doubt whether the water had imbibed a sufficient portion of the qualities of the raisins to produce the most humble imitation of wine; for it was not discoloured, but its taste did just impress a very faint sensation of sweet upon the palate. It was, however, suffered to remain till it became somewhat transparent, when it was bottled, for the sake of experiment, without having exhibited any signs of fermentation; and after some of it had remained two years, on being poured into glasses, it exhibited every appearance of Champaigne, hissed, sparkled, frothed, and threw up a brilliant spray exactly imitating that admired liquor. Its effects were not less extraordinary; for they were inebriating in a degree nearly equal to those of Port wine, though I am convinced there could not have been a portion of spirit in the liquor equal to one-fiftieth part of the whole.

It may also be observed, that bottled cider, fretting wines, &c. produce similar effects from the same cause.

The gas, or fixed air, resulting from the effervescence occasioned by the commixtion of acid and alkaline substances, is of this kind, as is evinced

evinced by the common mode of impregnating water therewith, in order to imitate that of Pyrmont, the apparatus for which is in the hands of most polite people. The effects of this air, without a particle of spirit, is a transient exhilaration (I will not call it *inebriation*) which passes off so much the sooner, on account of the total want of spirituous substance and generative principle in the fluid which produced it, to support its continuance.

To the same influence may be attributed the complaint of experienced topers, that they are sooner intoxicated by drinking different liquors than they should have been had they drank the same quantity of one sort, though equally strong. If mere spirit be the only efficient cause of intoxication, this commixtion of liquors could not produce the effect complained of; for, in that case, it would be indifferent what liquor becomes the vehicle of the spirit, so long as the quantum is the same; but this effect seems to originate from the probable commotion and effervescence of the heterogeneous commixture in the stomach, producing, or setting at liberty, a quantity of fixed air, which rising into the head, is the assistant cause of their complaint.

On the contrary, a sensible diminution of the inebriating effect is observable in malt-liquors grown vapid or flat, agreeably to what has been before suggested on that subject. And that the cause of this diminution is the same which occasions their vapidity, (*i. e.* the loss or escape of their fixed air) is evident from this consideration; that the difference in effect is producible in so short a time as that of a few hours, during which the exposure of the liquor could not have produced any perceptible diminution of the spirit, though it might completely have effected the escape of the fixed air, that being so much more volatile than the former as to be in a state of perpetual avolation.

If we recur to the sensations immediately consequent to the use of spirituous fluids, we shall perceive that those occasioned by a mixture of spirit and water are different from those which are the effect of strong malt-liquors; the probable cause of which is, that the strength of the former consists of mere spirit, and that of the latter is part spirit and part fixed air. The moment that a compound of spirit and water is taken into the stomach, it occasions a hot or ardent sensation; malt-liquor, on the contrary, excites first a gentle genial warmth, which improves into a mild glow of the stomach and intestines, and differs from the former in the same degree as the warmth of the sun does from the heat of a fire.

It is not an improbable supposition, that this difference arises from the different texture or consistence of the malt-liquor, whose spirituous particles are blunted or sheathed by the farinaceous mucilage with which it abounds; which also, enveloping and being the efficient cause of the fixed air, becomes the common medium through which both that and the spirit must act; whence that gentle sensation of warmth just mentioned, is the first and only effect, till the heat of the stomach has rarefied the air, and thence increased its action and tendency to rise, by which means those consequent sensations are effected. Hence those malt-liquors which are more abundant in fixed air, whether arising from the materials or the process, are softer upon the palate, and milder in their effect, than those which have less, though the inebriating quality of both may be finally equal.

These hints on the strength of malt-liquors may suffice for the present; and if they should be the means of exciting the curiosity and exercising the talents of ingenuity to a farther and more effectual enquiry on the subject, the purpose of their publication will be fully answered.

Practical Directions *for the general Application of the Instrument, in order to effect the Purposes before treated of.*

Having already pointed out the particular utility of the *Saccharometer*, in every particular stage of the brewing process, it may seem superfluous, perhaps impertinent, to a clear head and comprehensive understanding, to enter into a detail of circumstances sufficiently indicated or inferred in the preceding pages; but since it may not be the lot of every one, who may wish to derive information and advantage from the contents of these pages, to be classed under that description; and as there are some particulars to be inculcated which have not hitherto been fully explained, I chuse rather to hazard the imputation of prolixity and repetition, than that of wanting perspicuity and precision, where beneficial information is intended on a subject never before committed to the press.

To answer the desired purpose it is necessary to enter into the minutiæ of the business, and to indicate the direct manner of effecting the intended information; that every one, by clearly comprehending the *means*, may with certainty obtain the *end*.

The first preliminary step to be taken is the procuring correct tables of the contents of the under-back and coolers; the former indicating the quantity contained in every inch of its depth; the latter pointing out the quantity at every one-tenth part of an inch, and extending to about four inches, deeper than which a wort is seldom laid in the coolers.

A guaging rod is then to be provided, somewhat more in length than the whole depth of the under-back, which rod must be graduated into inches, subdivided into tenths, or at least into fourths, which latter division is in general sufficiently minute for the purposes of the under-

under-back; and where a small rule, divided into inches and tenths, is purposely provided for the coolers, there is no necessity for smaller graduations on the under-back-guage, if wanted for no other use, those being sufficiently near the truth for general practice.

The next thing necessary is a book, containing any number of leaves, of about the size of a half sheet of fool's-cap paper, ruled longitudinally into ten columns, for the purpose of a *diary* or *journal*; in which is to be inserted the particulars of every process, so far as they relate to the subject of which we are treating.

The first column is to contain *the date of the brewing.*

Second, the number of *quarters of malt used.*

Third, the *quantity of hops* employed.

Fourth, the barrels of *wort in the under-back*, the amount of the *expansion* being previously deducted.

Fifth, the *gravity of each wort* in the under-back.

Sixth, *the amount of the fermentable matter extracted* in each wort.

Seventh, the barrels of *cold wort in the coolers.*

Eighth, the *gravity of each wort in a fermentable state.*

Ninth, the *net aggregate of fermentable matter* remaining in each wort, at the above period.

Tenth,

Tenth, the amount of the *fermentable matter extracted from each quarter of malt.*

To these, as matter of not unuseful information, might be added two other columns:

The first, to shew the *specific gravity of the beer* in a state of quietude and transparency.

The second, to indicate the *amount of the attenuation,* or the difference between the average gravity of the wort, and the gravity of the beer in the state just mentioned.

In this journal our process before treated of would stand thus:

BREWING

BREWING TABLE BY THE SACCHAROMETER.

No. I.

Date.	Quarters of Malt.	pounds of Hops.	Wort in under-back.	Gravity.	Fermentable matter extracted.	Wort in Coolers.	Gravity.	Net fermentable matter remaining.	Fermentable matter perquarter	Gravity of Beer.	Attenuation.
1782.			31.47	28.5	889.0	21.5	34.25	736.37			
			29.4	17.6	574.4	22.0	25.5	561.0			
			30.26	9.25	279.9	20.5	16.5	338.25			
May 16	24	300	91.13	18.52	1686.3	64.0	25.55	1635.62	70.26	11.8	13.75

Supposing this brewing now to be proceeded upon, and that the saccharometer and necessary apparatus are at hand, so soon as the first tap is spent, and the mash-tun cocks are turned off, preparatory to the second mashing, we take out our specimen in an assay jar, and putting on the cover, place it in the jar-case before described, premising it to be already charged with cold water; by which means it is cooled to an assayable heat, by the time the business of mashing is over. At the same time also we note the heat of the wort with the thermometer, and taking the depth of it, with the guaging rod, we refer to the under-back table of contents, and against the number of inches which is the depth of the wort, have the number of barrels it contains. But this, as I have before explained, shewing only the quantity of the wort, in its then state of expansion, we make a minute or memorandum of the quantity and heat in any manner, to assist the memory, and so soon as the specific gravity of the wort is found, by the instrument, we have recourse to the *table of expansion,* according to which we deduct the amount of the expansion, correspondent to the heat and density of the wort, from its apparent contents, and enter into the journal only what would have been the real quantity, at fifty degrees of heat, supposing no evaporation to have taken place. Against this sum we immediately place its gravity, regulated by the *table of heat,* and multiplying the one by the other, we find the sum or aggregate of the fermentable matter the wort contains; which sum being then inserted in the next column, the journal appears thus:

BREWING TABLE BY THE SACCHAROMETER.

No. II.

Date.	*Quarters of Malt.*	*pounds of Hops.*	*Wort in under-back.*	*Gravity.*	*Fermentable matter extracted.*	*Wort in Coolers.*	*Gravity.*	*Net fermentable matter remaining.*	*Fermentable matter perquarter*	*Gravity of Beer.*	*Attenuation.*
1782.			31.47	28.5	889.0						
May 16	24	300									

Proceeding exactly in the same manner with the second and third worts, we insert them, in their turns, immediately under the first, in the proper columns, as shewn in the former example; and adding up the several quantities of the three worts, and the several sums of the fermentable matter extracted, we divide the aggregate sum of the wort in that of the fermentable matter, and the quotient is the average gravity of the raw wort; for instance, 91.13 divided in 1686.3 gives 18.52, the said average gravity; which division is, indeed, of no other use on the present occasion, than by being placed in a line with the quantity, gravity, and aggregate fermentable matter of the whole wort, in a fermentable state, to exhibit a comparative view of these particulars opposed to parallel circumstances in the raw extract, and thence to draw useful inferences not inapplicable to future practice.

It generally happens, that all the worts in the under-back are assayed before the first wort in the cooler is in a fermentable state, or sufficiently cool to be let into the gyle-tun; in which case the business of the raw extract, or wort, is entirely concluded, before that of the boiled is begun; and that, of course, the one occasions no interruption to the other.

Having finished and duly noted our experiments on this first part of the process, so soon as we find the first wort in the cooler in a proper state to let down, we dip it with our rule, graduated into inches and tenths, as accurately as possible, and take a specimen in an assay-jar. We then refer to the table of contents calculated for the cooler, and noting the quantity correspondent to the depth which it happens to be, we insert it in the next, or seventh column of our journal, just as it appears, because the evaporation has taken place; after which, having found its specific gravity with the instrument, and rectified it by the *Table of Heat*, we note it in the succeeding column, and multiplying the one by the other, insert the product, or net aggregate of fermentable

fermentable matter remaining, in the next, or ninth, column, in the same manner as has been done by the wort in the under-back.

The second wort, when in a similar state, is submitted to the same process, and is noted under the first, in the proper columns of the journal, as appears in the former of the preceding examples. Should this, however, not be entirely cool, before it be necessary to attend to the third wort in the copper, it will nevertheless be generally so far advanced towards that state, as to be at an assayable degree of heat; and as the evaporation which takes place within the limits of those degrees, is not very considerable, we may venture to take the guage and specimen, and make our calculation, in the same manner as if it had been entirely cool.

If, however, in any instance, this wort should not be at an assayable heat, at the time we want to proceed to a calculation of the average gravity, the assay-jar may be placed in the jar-case, to produce that effect. But it is to be remembered, that the jar is to be uncovered on this occasion, that such an evaporation may take place as the jar will admit; though, as I have elsewhere observed, that evaporation would be very inadequate to the effect of the cooler.

This calculation of an average gravity I have before shewn to be effected by adding the net aggregates of the two worts together, and dividing the sum by the number of barrels contained in them both, in order to discover the average gravity of those two; which being considered as the gravity of two-thirds of the intended gyle, we immediately proceed to calculate therefrom, in the manner before inculcated, to what gravity the third wort must be evaporated, in order to produce the average gravity required in the whole. But this business having been already fully explained, it only remains for us to indicate the mechanical or manual mode of producing the desired effect.

Herein we are primarily to consider how near the previous gravity of the raw wort approaches to the final gravity intended, and according to its approximation to, or distance from, it, to be earlier or later in our application of the instrument to the boiling wort, that we may not waste our time by unnecessary attention, nor our property by a careless remissness.

A little experience will direct our judgment in this particular; for, by observing what portion of time is in general necessary to effect any given increase of gravity, we can, *ceteris paribus*, judge so nearly of the time requisite for any other increase, as not to risk an error, especially if we are careful to begin our experiments a little earlier than we suppose it to be absolutely necessary; a precaution not unworthy attention. Thus, if by experience we find, that a gravity of ten pounds per barrel will be increased to fifteen, in three hours boiling, it would be advisable to take a specimen and make an experiment, after the wort has boiled two hours and an half; and to adopt a similar precaution on any other occasion.

These particulars being premised, and the time recommended for making the first experiment being arrived, we take the refrigerator, and having fixed on the perforated lid, we plunge it into the boiling wort. As soon as it is full, of which we can judge by its weight, we take it out, remove the perforated lid, put on the whole lid, and immediately immerse it in a pail or tub of cold water of sufficient depth to reach nearly to the top, being careful that none of the water be mixed with the wort, by ruffling the surface, or causing an undulating motion in it, on immersing the refrigerator.

Having now the saccharometer, thermometer, and assay-jar at hand, in about one minute's time, or a little more, the wort will be in an assayable state. This is best known by slipping off the lid of the refrigerator, and applying the thermometer, at the end of that period; when

when (if we find the wort at an assayable degree of heat) we immediately pour the wort into the assay jar, and try the specific gravity with the saccharometer; the whole of which, as I have before intimated, may, without the assistance of extraordinary dexterity, be effected in about two minutes.

If by this experiment we find the wort has not yet arrived at the gravity required in the copper, we suffer it to continue boiling, and repeat the experiment at such intervals as our judgment indicates to be necessary, till we perceive that our intended gravity is produced; at which time the fire is to be immediately damped, or drawn off, and the wort turned into the coolers.

When this wort is also cool, we take the guage and the specimen, and finding its quantity by the table, and its gravity by the instrument, we insert them ordinally in the seventh and eighth columns of the journal, under those of the preceding worts; and multiplying, as before, the quantity by the gravity, we discover the net aggregate of fermentable matter it contains, which we insert in like manner in the ninth column. Then adding the several quantities of the three worts together, and their several aggregates of fermentable matter, we draw a line, and note their sums in their respective columns; not neglecting to divide the latter by the former, in order to discover the average gravity of the whole, which we insert between the said sums, in the column of gravity.

This being all that is necessary to be done respecting the worts, we divide the gross sum of the fermentable matter produced, by the number of quarters of malt employed, and the quotient shews the number of pounds of fermentable matter extracted from every quarter of malt, or the intrinsic value of it, which is noted in the tenth column. In the example before us, the fermentable matter is 1686.3

 pounds,

pounds, which, divided by 24 quarters, produces 70.26 pounds, the amount extracted from every quarter used.

At this period our journal, at a single view, and in one line, presents us with the following useful information:

1. The materials employed.

2. The gross value of the malt, indicated by the aggregate amount of the extract.

3. The net sum of the product of the materials; the specification of whose value comprises a plain definition of the quantity and quality of the whole wort, in a fermentable state.

4. The specific value of the malt explicitly defined.

If to these particulars we add the two columns above-mentioned, in that case we take the first opportunity of obtaining the gravity of the beer when transparent, and note it in the former; which being then deducted from the final average gravity of the wort, the difference (inserted in the last column) shews how much of the fermentable matter has been attenuated by the action of fermentation, intimating thereby the force of that operation, and its relative influence on the strength of the beer produced, according to the principles which have lately been the subject of our investigation.

Incidental Circumstances, *in which the* Saccharometer *may be of considerable Utility.*

I have already had occasion to point out the use of the saccharometer in ascertaining the value of malts; but there are circumstances attendant

attendant on the use of it in brewing, which, not being common, I have not yet mentioned. One of these, is that disagreeable accident technically termed *setting the goods;* which is, the converting the malt in the mash-tun into a pasty, clammy, gelatinous consistence, by an injudicious application of improper heat in the liquor, or water, used for mashing, or from some other cause; the concomitant effect of which is a great deficiency in both the quantity and quality of the extract, in the detection of which the use of the instrument is singularly advantageous.

The occurrence of this accident *totally* is not, indeed, frequent; but I apprehend that its *partial* appearance is more common than many are apt to imagine. If the brewer knows how much liquor he turns upon the malt, he also knows what quantity of wort he should have in the under-back, if the malt be good, and the process has been properly conducted. Should this fall short in so large a proportion as one-third or one-fourth part, the goods may be said to be *totally* set; if in a less, they are *partially* set.

In either of these cases, if he estimates his loss by the quantity deficient, or attempts to make good the deficiency by a fresh application of water, on a supposition that his wort is strong in proportion to the shortness of the length, or smallness of the quantity extracted, he is egregiously wrong. The instrument will shew him, that not only his quantity is less, but the strength of the gravity of the extract is also deficient; from the discovery of which he will be enabled to guard against injuring the reputation of his beer, by a false estimate of its strength on that occasion, and will be prepared to provide for the prevention or remedy of similar accidents in future; for his loss being accurately ascertained, the discovery will naturally excite an enquiry as to the efficient cause of it; and whether that be found to have existed in the materials or the process, the experienced brewer will thence adopt a practice productive of better effects. This, however,

ever, is applicable rather to a *partial* than to a *total* setting of the goods; for an accident of the latter kind will force itself upon the attention of the most ignorant and careless, whilst there are degrees of the former which will escape the notice of the intelligent and attentive, without the means here recommended.

An accident of this kind once came within my own observation, wherein, by the inattention of a servant, the goods were so far *set*, that by two mashings, adopted to produce the usual length of one, the gravity of the wort, which should have been thirty pounds per barrel, was only eleven, and still the quantity was somewhat less, being thirty-one instead of thirty-two barrels; the loss, therefore, in the first extract only may be thus estimated:

			Pounds.
First wort should have been 32 barrels, at 30	—	—	960
Instead of which, it was only 31, at 11 —	—	—	341
	Deficiency	—	619

Which being divided by 75 pounds, the average amount of the fermentable matter then extractable from a quarter of malt, the actual loss appears to be 8.25 quarters of malt.

In a situation so alarming, without the instrument for my guide, I should have been totally at a loss how to have proceeded, or to what purpose to have converted a wort, whose quality must have been unknown to me. Similar accidents, though in a less wasteful degree, I am convinced do frequently occur and pass unnoticed, in the want of these or similar means of discovering them.

Amongst

Amongst the causes of such accidents may be reckoned the use of very low-ground, and very high-dried, malts, with improper degrees of heat of the liquor applied to them; and that of stubborn, flinty, ill-made malts, and of such as are just off the kiln, though attended with what would have been termed *proper heats* on other occasions.

By the use of the saccharometer, also, we are enabled to detect that absurdity in the practice of many country brewers, which the notable dames of yore agreed to call *leaking on*, a term which means nothing more than the continued sprinkling of water upon the malt, after the tap is nearly spent, till the quantity of wort is produced which the brewer thinks will yield the required length, or quantity of beer, without any regard to the quality of the malt, or that of the wort so produced.

The least reflection, without the aid of the instrument, will point out the absurdity, though reflection alone will not inform us how much is lost by the practice; for what power, or what time, has a fluid to extract, which is sprinkled over the surface of the materials, and immediately trickles out below, without being allowed a stationary moment for infusion? And, though the practice I am here condemning is confined to some small breweries in the country, I cannot exempt the larger ones from all share of censure on the occasion; for, if the *piece-liquor* of some of them is not exactly in that predicament, it verges so very nearly upon it, that I cannot pass it over without recommending the subject to the consideration of the proprietors.

Another circumstance wherein the utility of the instrument is obvious, is the being able to produce the same strength in any malt-liquor, which we are desirous should be substituted for some other, the produce of another place. If, for example, we would imitate Burton ale, Ringwood beer, or London porter, by being previously informed

informed of the respective average gravities of the worts which produce them, we can be correct in the imitation of their strength, a particular of which we cannot be assured by any other means; and this is of the greater importance, because the malts made in one place frequently differ very much in quality from those made in another.

To exemplify this, I will suppose that a brewer of Edinburgh, being informed that the London brewery draws two barrels and a half, or two barrels and three firkins of porter, from a quarter of malt, immediately set to work, and drew a length in that proportion, without considering the difference in the quality of the malt brought to the London market, and that produced in Scotland, we may readily suppose, that he would find his liquor exceedingly deficient in point of strength, and himself much disappointed. On the contrary, if, being willing to make a random allowance for the supposed deficiency in the quality of the malt, he were to draw only two barrels per quarter, when perhaps it would have afforded two barrels and a firkin, he is then trading to a disadvantage which a knowledge of the strength of London porter, and the application of the saccharometer, would have prevented.

By means of an instrument, too, the perfect analysis of malt-liquor might, perhaps, be effected, with the view of discovering, with certainty and precision, the constituent parts of its strength; and this discovery, by an ingenious hand, might lead to further advantages.

If the gravity of a given quantity of perfectly transparent wort * were taken, and the portion of solid yeast used to ferment it were exactly

* It may not be unworthy observation, that wort in its natural state of turbidity appears less dense than when transparent; but the difference is very trivial. A wort of 49.75 pounds per barrel, in the former case, was exactly 50, when filtered through a flannel bag to perfect transparency; but, not having had occasion to make any other experiments on this subject, I give it as the result of one only.

exactly weighed; by taking again the gravity, and noting the quantity of the beer, in a transparent state, having previously weighed with precision the quantity of yeast and lees produced from it, perhaps a clue might be taken hold of which might direct to the discovery of the analytical process we are solicitous of. The amount of the yeast and the lees, added to that of the unattenuated fermentable matter, should make a sum equivalent to the sum of yeast first used, and the amount of the fermentable matter extracted; it would then remain to be ascertained—how much fixed air had escaped during the fermentation—what portion remained enveloped in the unattenuated fermentable matter—the amount of the spirit generated—and what portion of water made up the measure of the composition *.

At least, the object seems worthy the attempt of any one who may have leisure, ingenuity, and inclination enough to undertake it; and should it not answer the end proposed, the enquiry is not incurious, nor unpromising of useful information; for, as Dr. Hales has well observed, "New experiments and discoveries do usually owe their first rise only to lucky guesses and probable conjectures; and even disappointments in these conjectures do often lead to the thing sought for."

After what has been said upon the various, new, and useful purposes to which the saccharometer may be applied, I think it superfluous to dwell longer upon the subject; and therefore submit it to the reader to adopt or reject the use of it, as his own understanding may dictate.

(Thus far Mr. Richardson.)

BREWING

* From cursory observation I find, that a wort of forty pounds per barrel, though attenuated down to twelve or thirteen, does not produce of solid yeast and lees more than ten pounds per barrel, whence the quantity of fixed air escaped must, in such cases, amount to near one-half of the acquired density of the wort.

BREWING FOR PORTER.

I. Grist. Malt, it is well known, yields less in proportion as it is high-dried, that is, the browner the malt, the less the produce, consequently, the paler the malt, the greater the produce, provided it is properly malted. Porter owed its flavour, in a great degree, as has been before observed, to very high-dried brown malt, almost candied at the kiln. Very little pale malt was used in brewing for porter fifty years ago; *colouring* was then a novel thing; grain was cheap, and brewing, as a *science*, but little understood; the rate materials sold at fluctuating, and the price of porter stationary; the former being generally on the increase, obliged men of observation in the brewing line to study the best mode of serving their customers, without impoverishing themselves, which was only to be accomplished by decreasing the quantity of brown, and proportionally increasing the pale malt used, and making use of colouring matter to preserve a good *face* to the article brewed. This being a work of time, and done gradually, the change of *flavour* was not perceptible. Those who less hastily went into this method began with the increase of amber malt, fearing the change might be discovered if they adventured on pale malt first, as it was not for a length of time that they found out colour gave flavour, or at least assisted it.

When *grists*, from these improvements, became more interesting, a knowledge of them, and the *heat of the liquors* turned over, were considerations of importance to the brewer, as frequent miscarriages happened to the young, and even sometimes to the elder brewer, from

from not accommodating the *heat* to the composition of the grist;—the acquirement of this kind of knowledge from observation and experience first placed the *common* brewer above the private or *family brewer.* The *higher* we can venture to take the first liquor, the *paler* and clearer will the extract be. The *lower* we turn the first liquor over, the more *colour* it will extract from the goods, and the fuller the extract will be. The *paler* the *malt,* the *higher* heat it admits of; the higher dried and browner, the reverse.

II. Heat of the Liquor. In brewing for porter, when the grist is composed of equal parts of brown, amber, and pale malt, we may advantageously fix a standard heat in this way; one hundred and fifty degrees for the brown, one hundred and sixty degrees for the amber, and one hundred and eighty degrees for the pale malt, of which one hundred and sixty-three degrees is the medium or average heat; turning over the first liquor to suit the brown, the second to suit the amber, and the third liquor to correspond with the pale malt. The fourth is of little importance, while the first always stamps the quality of the future extract.

III. Length, no doubt, was always a primary consideration with the common brewer, the management of which to advantage became more a study as the price of materials rose, until, at last, brewing became a science; hence the *heat of the liquors,* and *the length drawn,* were kept secret in every brewhouse. The first brought the *thermometer,* and the last the *hydrometer* into use; but a deep-rooted prejudice against innovation has much retarded their application, particularly of the latter, notwithstanding the wealth of every house has increased in proportion as they *earlier* or *later* adopted their use, particularly of the *latter.*

IV. Boiling. Long boiling, and the consequent injury done to the worts by it, may be conveniently avoided by *short-liquors* and *stiff-*

mashes,

mashes, as there will be less to evaporate, or boil down to the *intended quantity* or *standard gravity,* and thereby less of the *volatile principle* of the malt and *hops* dissipated, to the annoyance of the neighbourhood, and the brewers' loss of *materials* and *fuel.* In consequence of short boiling, the hops should be more divided than they usually are at putting into the copper, as they will have the less time there to be broken up, and their strength duly extracted. If the boiling is short it must be proportionally rapid; the boiled worts may be safely turned out of the copper some minutes after the *criterion* appears, if they have boiled an hour. It is a bad practice to keep the first worts boiling before the *hops* are added; or to suffer them to do more than simmer while waiting for the second worts to be added. It is from over-boiling, and under-attenuation, that strong beers and ales owe their *gluey rawness,* and glutinous fullness, that passes with some for body and strength. In the *application* of these rules, the abuse of *over-boiling* is further pointed out.

V. Attenuation: Or, the Doctrine of Fermentation, has progressively improved since the introduction of the thermometer and hydrometer into use. This *standard* has been found the *golden rule* of brewing a sound good extract from *mixed grists;* and at once raises the *common,* out of the reach of the *private, brewer,* who was, until then, as deficient in the *science of brewing,* as the other has always been in the *practice.*

By the help of these instruments we see our way clearly over the ground we formerly groped, by which we firmly tread in safety; we know the value of every malt we use; whose malts deserve a preference; and we know to what *length* we can draw them, and what *heat* will best suit each kind of malt; and how to form *standard heats,* to correspond with the *composition of our respective grists.*

We

We not only *pitch*, or bring our worts together in the gyle-tun, with certainty and security, but also attenuate or ferment them there to the greatest advantage; note their increasing *heat* and decreasing *gravity*, and uniformly know the most advantageous moment to *cleanse* at. Let us now see the Application of these advantages, or the difference between groping our way and seeing it clearly, so as to give satisfaction to our customers, while we profitably obtain credit for ourselves. These instruments, by enabling us to ascertain the value of each kind of malt, not only show the price each deserve, but also point out the best and most safe mode of composing our grists, and of applying the most suitable heat to our respective liquors, acquainting us at the same time to what length they are to be drawn. For instance, brown malt averages about fifty-six pounds, specific gravity, per quarter, amber about seventy pounds, and pale malt about eighty pounds per quarter, to compute them respectivly at their medium hydrometrical weight.

VI. Porter brewed from grists composed of equal parts of these three sorts of malt, the medium weight per quarter would be about sixty-eight pounds, from which we could safely draw three barrels per quarter, weighing nearly twenty-three pounds per barrel; this beer attenuated to five, six, or seven pounds per barrel, is fit either for *keeping* or *exporting*.

Running gyles of mild for present use; three barrels and an half from this grist will weigh nineteen pounds per barrel, which, attenuated to six, seven, or eight pounds per barrel, will be equal to the gravity given by many houses of established credit in London.

There may be some who draw a greater length per quarter, and yet have a stronger beer. It is done in this way, they lessen the portion of brown, and increase the pale or amber malt; others use all amber; and

a few

a few capital houses all pale malt, for their *porter,* colour *high,* and *attenuate low*, that is, down to a few pounds.

These last meet with no accidents from the heat of their liquors, it being more difficult to brew from *mixed grists* than from a grist of any one kind of malt. There is none, except *raw malts,* which are known to absorb more liquor the first *mash* than well-dried malts, yet these malts usually *spend well,* when the first liquor is not taken *over-high,* if *well-steeped* in the *couch,* and *full-grown* on the *floor*; they then leave a floury mellowness in the mouth, when biting the sample.

For *stale beer* pale malt should be used, from which at least four barrels per quarter may be drawn, at eighteen or nineteen pounds per barrel; ferment vigorously, beat the head in before cleansing, and colour high, as all lean or thin beers ought to be, it giving them an apparent strength; they naturally having a briskness and pungency from this treatment, if kept in air-tight casks; which will please the majority of customers; when much stronger beers, from *over-boiling,* and want of due attenuation, have a flat sizy fullness, and a gross disgusting heaviness, to most palates, and do not come forward sufficiently fast to *rot* the *hop,* as it is called, or overcome its bitterness, from which they are unpleasantly bitter, if early drank.

Here it may be thought attenuation promotes sourness or acidity; certainly not, acidity indeed overcomes bitterness. *Strong worts* should be attenuated most, they becoming spirituous in proportion to attenuation, spirituosity being the soul of good strong beer, and consequently their best preservative. It is, therefore, strong beers that have the stamina for attenuation, and derive their strength and animation from it. Such beers and ales, when well attenuated, become as spirituous and pure as old wines. Neither grape wines nor malt wines,

wines, when duly attenuated, sicken, or rise,—the fermentable matter in both being fully resolved into spirit, leaves nothing to rise or sicken by a subsequent, or spontaneous fermentation in warm weather; the unattenuated matter in both rendering them susceptible of disease. Nor do they lose their racy fullness on the palate by it, as some have mistakenly imagined, it being only their gross sizyness that is done away, and with it their flat heaviness. The porter of the present day owes more of its flavour to a vigorous fermentation than to the high-drying of the malt. Colour also gives flavour. The fault of many beers and ales lays in the *cleansing too young*, where the strength or gravity is considerable.

Eight or nine pounds gravity in the strongest beers and ales is fully sufficient to leave *unattenuated at cleansing*; and six or seven in common beers and ales. If the vats or casks in which these beers and ales are started, or stowed away, are air-tight, these quantities of unattenuated fermentable matter will be found amply sufficient to furnish gas for pungency and sparkling in the cup; if they are not, two thirds of their gravity left unattenuated will not procure it, as it is otherwise lost as quick as generated. Under these circumstances, these malt-liquors must be bottled to gain pungency, and mantle in the glass. See the *Process* and *Bottling*. *Fullness* is derived from the moderately low heat of the first liquor. Attenuation is a modern term, not unaptly applied to *fermentation*, both of which may be seen under their respective heads.

Notwithstanding the advantage that good materials give one house over another, which is great indeed, there are houses of established credit in town, who, without such advantages, have an article with as much, or more credit to themselves, enjoying at once the pleasure of pleasing their customers, and enriching themselves. This is the grand desideratum in brewing, and easy to be obtained, by closely following

following the concise system here laid down. To have a good system and not scrupulously exact in following it, is wasting the substance in pursuing of shadows. *Reform* never goes down well when it comes in the shape of a sudden change; to be lasting, it should be gradually brought about, even to render it palatable to those for whose benefit it is intended.

For instance, it will not do to send light stale beer, and thin mild beer, to be drawn together, especially in an old established house that has the reputation of drawing full strong beer. It is a better way to send in strong *mild* beer, with the *new*-brewed thin stale beer; and *thin mild* beer to those houses that have a stock of *full strong* beer on hand. The houses resorted to for *full strong* beer should be served with *full mild* beer, and *new*-brewed *thin* stale beer, and the *keeping beers* reserved as much as possible for redressing complaints, bottling, and exportation.

A particular description of Malt and Hops I have here passed over, with respect to the quality and choice of each; except with regard to the *colour* and *fermentable matter* of the *former;* and the careful dividing of the *latter*, as they are put into the copper to the first worts; experience having long ago taught the brewer to distinguish their quality, and direct him in the choice of each; therefore, I shall only observe here, that the rule laid down for finding the quantity of fermentable matter per quarter in malt, and thereby distinguishing the value of *malts*, is, in a great degree, applicable to *hops*. *See Malt and Hops.*

From six to seven pounds of the best hops will be sufficient for a quarter of the best malt, and in general for three barrels and an half of *porter*, when not intended for keeping beer, or *stout*. From two

two pounds and an half to three pounds per barrel for *stout and keeping beers* will be sufficient.

OLD HOCK,

Is, in fact, *pale*, or *white porter*, and usually drawn of the same gravity as keeping beer, brown stout, and entire butt beer. It is prepared from pale malt, and occasionally sold under the name of *Old Hock*, but oftner employed to *make-up* weak porter, declining and returned beer, having previously received the colour or complexion of the beer it is intended to make-up; which is taking no greater latitude in the preparation of our *malt-wines*, than neighbouring nations do in the making-up of the wines they prepare for market, as may be seen at large in the *Appendix on Foreign Wines*. In those *countries*, wine being the common beverage, it is necessarily drawn from the *wood*, as our beer or ale is for the consumers, and made up in the measure it is drawn in to the palate of the customer, dry or sweet, mellow or tart, taken from different pipes or other casks, in similar manner as we draw our malt-liquors. To provide for this, when the *publican* orders any number of butts of porter, the *brewer* sends in one-third *stale*, and two-thirds *mild* beer; but if the beer is *old*, or drawn early in the season, one butt may be sufficient to run off four or five of mild, according to the taste of the customers and the situation of the *publick-house*, as they like it mild or stale.

Old hock differing in nothing from porter, but in colour and flavour, and but partially in the latter, there is no other difference in the preparation but what relates to these circumstances, except that

 the

the brewing of old hock is not so complex an operation in taking the heat of the liquors, there being less difficulty and risk in brewing an intire grist than a mixed one ; consequently the *heats* will approximate in some degree towards those taken for ale brewed from all *pale malt*, which may be seen are considerably higher than could be used for the mixed grist made up for porter. Therefore, in shewing how porter is to be flavoured and coloured, we explain what more is necessary to be known about brewing and preparing *old hock*.

The colour commonly made use of for Porter, is usually prepared from *molasses,* boiled until it is considerably darker, bitter, and of a thicker consistence, and when judiciously made, at the close of the boiling it is set on fire, and suffered to burn five or six minutes or more; then it is extinguished and cautiously diluted with water to the original consistence of treacle; the burning or setting it on fire gives it the greatest part of its flavour, which is an agreeable *bitterness,* and burns out the unassimilating oil.* MUSCOVADO, OR RAW SUGAR, when treated in a similar manner and diluted to the same consistence before it sets, obtains a bitterness that more nearly strikes the porter flavour on the palate. It is of a deep dark colour between black and red, and has been affectedly called *essentia bina.* To prepare it to advantage, take three pounds, or three hundred weight of Muscovado sugar for every two pounds or two hundred weight of *essentia bina* intended to be made, put it into an iron boiler set in brick work, so that the flue for conveying the flame and smoke of the fire into the chimney should rise but about two thirds of the heigth of the boiler, in its passage to the chimney. The boiler should have a socket or pivot in the center of its bottom, to receive a spindle of wrought iron, with a crank in it above the brim of the boiler, the upper end of which turns in a correspondent pivot, in an iron bar, fixed across, several feet above the boiler, with a transverse iron arm to reach from the crank some feet over the boiler, for a man to stand and turn it with its scraper, to keep the sugar from

* The same may be said of *essentia bina,* the genuine colouring substance and flavouring ingredient for Porter.

from burning at the bottom before the upper part melts; this arm may be placed in a wooden handle at the end held by the man, or it might be too hot for his hand.

Put a gallon of water into the boiler to every hundred weight of sugar to be employed, that is, a pint to every fourteen pounds weight of sugar; then add the sugar, light the fire, and keep it stirring until it boils, regulating the fire so, as not to suffer it to boil over; as it begins to lessen in quantity, dip the end of the poker in, to see if it *candies* as it cools, and grows proportionally bitter to its consistence. Mark the height of the sugar in the boiler when it is all melted, to assist in judging of its decrease. When the specimen taken out *candies*, or *sets* hard, pretty quickly, put out the fire under the boiler, and set the vapour or smoke arising from the boiler on fire, which will communicate to the boiling sugar, and let it burn for ten or twelve minutes, or more, then extinguish it with a cover, ready provided for the purpose, and faced with iron, to be let down with a chain so as to exactly close the boiler. Soon as it is extinguished, cautiously add *strong lime water*, by a little at a time, working the *iron stirrer* in it to equally dilute it all alike to the consistence of treacle, before it sets in the boiler, which it would do as the heat declined, in a manner that would give a great deal of trouble to dilute it after, and be imperfectly done then. It is easy to conceive this sort of work requires to be done in an open place or out-house to prevent accidents from fire.

If the *essentia bina* is neither burned too little or too much, it is a rich, high flavoured, grateful bitter, that preserves and gives an inimitable *flavour* and good *face* to porter; to be added in proportion as the nature and composition of the grist is varied with a greater or smaller portion of pale malt. *To convert old hock to brown stout,* it will take three pounds of common, or indifferently well-made *essentia* per barrel, and but two pounds of the best. It should weigh full ten pounds a

 gallon

gallon. *The essentia bina* should be mixed up with some finings, and roused into the tun, soon after the yeasty head gathers pretty strong, in order to undergo the decomposing power of fermentation; part of it being prone to float in the beer under the form of a *flying lee,* when employed in the usual way of colour. With this precaution, the colouring and preservative parts unite with the beer, and the grosser charry parts precipitate with the *lees* and other fecculencies in the tun, previous to cleansing, adding a *firm,* or keeping quality to the beer.

Lime-water for diluting the burnt sugar in the preparation of essentia bina. Thirty pounds of lime will make one hundred and twenty gallons or more of *lime-water*. Put fresh lime from the kiln, previously slacked into coarse powder, into an air-tight cask; gradually add the water, stirring up the lime all the time to expose a fresh surface to the solvent power of the water, which will rarely dissolve more than an ounce troy weight on the gallon, or retain so much when kept ever so closely excluded from external air. If the lime was first grossly pounded and slacked in the cask, the lime water might be made still stronger. The reason of directing the water to be slowly and cautiously added at the first, is for the more conveniently mixing the lime with the water, which otherwise would not be properly wet, but clotted into lumps, and defended from its action; by slacking and mixing in the vessel, the water is less impregnated with the carbonic gas, or fixed air, from the admission of the atmospheric air. Do not fill the vessel within a few gallons, that the cask (if a moveable one) may be rolled over and over, fifteen or twenty times, before left to settle, in order to have the water fully saturated with the lime; when settled perfectly clear, it may be used to dilute the *essentia bina*. N. B. *Lime water* should not be used to dilute the *essentia bina,* however conducive to flavour, where *heading* is used, as it forms an execrable odour with the saline substances used for that purpose; in this case common water may be employed, or strong wort, or a batter of brown malt meal, either of which makes it a more powerful *flavourer*.

THE PROCESS OF BREWING FOR PORTER.

First Mash. Presuming the *grist* composed of equal parts of pale, amber, and brown, malts, ground into the mash-tun the preceding day, remove the cover, and turn on your liquor at the heat of one hundred and fifty degrees of Farenheit's thermometer,* at the rate of two barrels per quarter; mash until all the balls and clots of malt are well broke up, and the whole of the goods well blended together, so as to form one uniform mass; lay the surface smooth, put on the cover; let this be performed within an hour, or, if possible, in less time, the object of mashing being only an equal and perfect incorporation of the malt with the liquor; let the whole stand an hour, then set the tap running, and examine whether the worts run fine, and to your expectation; if it does, let the tap run faster; when the tap has spent for a quarter of an hour, take the heat of the wort; complete the running of the tap with all convenient speed, and get your second liquor *forward*. Presuming every thing is ready within two hours and three quarters, or three hours at most, begin the

Second Mash. Turn over the second liquor at one hundred and sixty degrees, at the rate of one barrel per quarter, and mash as before, but for half an hour, or at most three quarters; cover up the mash-tun as before; allow for the standing of the tap one hour; then set tap, and take the heat as before; allow but half an hour for the running of this tap, and three quarters of an hour for the running of the first tap, if it can be conveniently accomplished in that time. Presuming every thing is ready within two hours or two hours and an half at most. Get ready for the

Third Mash. Turn over your third liquor at one hundred and eighty degrees, at the rate of one barrel and a firkin per quarter; mash half an

* See remarks on the mean of the heats, page 246, where this low heat is accounted for, and proposed to be increased with the gravity of the brown malt: and the *Note*, page 247.

an hour; let the tap stand with the tun covered, as before, one hour; then set tap, take the heat, and let it spend quickly. The fourth liquor may be cold, or only blood warm, as convenient, and no more used than what will barely cover the goods; the tap may stand an hour or two, as it may suit. This liquor may be literally *turned over*, that is, caused to descend through the goods, (if the other liquors ascended, as they usually do) and need not be mashed, for which the fourth wort will be some pounds per barrel the stronger; it will do to make *sours* to cut the glass; that is, to dissolve the isinglass, for making *finings*. *See Finings.*

If the three first mashes can be completed in eight or nine hours, Porter may be brewed in warm weather with safety. If the coolers of the brewhouse are large enough to lay the worts sufficiently thin after they are boiled, and the boiling done in three or four hours, so as they may be all cooled ready to be brought together in the gyle-tun, or *squares*, exactly half an hour before sun-rise, * there can be no danger of their suffering a change in the coolers before they are *pitched* next morning, which is of the utmost consequence in warm weather, as running gyles for mild beer might then be brewed during the summer months. In cool or cold weather, *pitch* at fifty-five or sixty degrees, having previously set a few barrels of the first worts to ferment with a few gallons of yeast, between these two degrees of heat, and bring them altogether in the tun or square, as soon as the heat they acquired in the copper sinks to the above temperature, which are good fermentable heats. In winter time, or cold weather, the *pitching heat* may be from fifty-eight to sixty-eight degrees; and the standing of each tap, &c. may be protracted, at the discretion of the brewer.

The mean of the heats that the above three liquors are turned over at, is one hundred and sixty degrees, a heat that some brewers prefer for the first liquor of their mixed grist, but I have given the former rule the preference in practice, increasing the heat of the first liquor with the gravity of the brown malt.

* The coldest part of the twenty-four hours.

Although there are pale malts that yield from eighty-five to ninety pounds per quarter, and upwards; amber, from seventy to eighty pounds; and brown malts, from sixty to seventy pounds per quarter; I compute these three sorts of malt at fifty, sixty, and seventy pounds per quarter, which is one hundred and eighty pounds in toto; this, divided by three, the mean number, gives the average at sixty pounds per quarter, which would yield three barrels of porter, at twenty pounds per barrel, for running gyles of mild beer. But to take the country throughout, it would come nearer the mark to say, pale, seventy-six pounds; amber, sixty-six pounds; and brown, fifty-six pounds per quarter; the mean of which is sixty-six pounds per quarter, yielding three barrels of keeping beer at twenty-two pounds per barrel. The fair average of the best malts sold at the Corn Exchange, London, is, eighty, seventy, and sixty pounds per quarter, which, by the preceding computation, gives two hundred and ten pounds in the aggregate, and seventy-three one-third of a pound per quarter, producing an average gravity of twenty-four and an half pounds per barrel; this is much about the strength of *stout*. While pale malt only, at eighty-one pounds per quarter, will produce old hock at twenty-seven pounds per barrel. See some interesting particulars under *Brewing for Ale*.

The best porter brewers we have had, always took the heat of the taps, the mean of which they studied to bring to one hundred and forty-five degrees, as such brewings succeeded best that produced that mean. It was an invariable rule with these men never to bring their liquor *through*, that is, to let it come to a boiling heat, and I think they were right, as boiling would divest the water of its air. The use of the instruments and their application to brewing have been already described. *See page* 174, *Book the First*, &c.

COUNTRY

* This is a good average for the heat of the liquors, sixty, seventy, and eighty degrees. When the third heat is made the highest, the tap must stand the shorter in warm weather.

COUNTRY ALES, OR, ENGLISH BEERS AND ALES.

Many of the country ales and beers still retain their brown colour, which they have done much longer than their original strength; yet some of them do not want for strength, particularly those drawn mostly from mixtures of pale and amber malts, coloured high, which it must be allowed gives them a better face as well as a stronger appearance than they possess, and in some degree improves their quality. This also gives a beerish flavour, which, from custom, becomes a local indispensible. As we brew for the consumers, consequently should please our customers, who must have their nut-brown ale, their amber, or pale ale, as well as their strong brown beer.

There are some of these beers and ales about the country, that are brewed from a wort not less than eight and nine and twenty pounds specific gravity per barrel. This is sufficiently strong for every useful purpose that malt-liquor is capable of supplying; and some still stronger, as Burton ale, Dorchester beer, many home-brewed malt-liquors, &c.

BURTON ALE.

Formerly *Burton ale, Dorchester beer,* and other strong country ales and beers brewed in England, were more drank in London than they have recently been.* *German Mum,* a famous and very potent malt

* In order to discourage the importation of malt liquors, and encourage the consumption of our own, there was a duty of three shilling per barrel imposed on the importation of beer and

malt liquor was imported in considerable quantity, and drank very freely in the sixteenth century, when meat breakfasts and strong drink were much in vogue. The importation of foreign malt liquors was a stimulous to our own brewers to excel. Then Burton ale, Dorchester beer, strong *London porter*, called *intire butt beer*, better known at present by the name of *brown stout*, proved our ability to make as palatable and wholesome malt liquors as our neighbours, and in proportion as the legislature laid a proportionate duty on the foreign importation of malt liquors, our own brewery had fair play, and at length they became so good a succedaneum to such impolitic importations as soon to supersede them.

Burton ale has always been prepared from pale malt. Malt was neither so dear nor so good as at present, and not bearing a price proportioned to the ale or beer prepared from it, when the first worts obtained from two or more mash tuns were not thought sufficiently rich, the second and sometimes the first worts were saturated with fresh malt, by pouring it over the fresh malt in another mash-tun.

This mode of work not corresponding with the present enormous price of malt, I would recommend to the brewers of Burton ale to employ the best malt, equal at least to from eighty-two to eighty-eight pounds per quarter specific gravity; the first and second worts of which would be full strong and rich enough, without the addition of fresh malt to super-saturate the wort.

and ale by the 12th of Charles II. and increased to six before the expiration of the same year. The 4th of William and Mary there was three shillings more laid on, and in the 5th of the same reign three shillings; and by the 4th of Anne three shillings, in all fifteen shillings per barrel; this, with the rapid progress of improvement made in our brewery 1661, the 12th of Charles II. to 1714, the 12th of Anne, comprehending no longer space of time than fifty-three years, so effectually excluded any material importation of foreign malt liquors, as nearly to prove tantamount to a prohibition.

Which may be done as follows. Let the brewer confine himself to *stiff mashes*, by taking his liquors short; grind his malt coarse, and from the mill into the mash-tun close covered up, to lay thirty-six to forty-eight hours before the first liquor is turned over, which should not exceed the heat of one hundred and eighty degrees, nor be under one hundred and seventy-five degrees, and the second liquor from one hundred and eighty-five, to one hundred and ninety degrees, of Farenheit's thermometer; then the first wort would be full forty-three pounds, and the second at least twenty-nine pounds gravity per barrel, the mean of which is thirty-six pounds per barrel. The necessary time of boiling the hops and cooling the worts would increase this to forty pounds per barrel, by the time it entered the gyle-tun. These worts, and the subsequent ale would be full as rich as at present, without the long boiling now practised, which renders Burton ale so glutinous, and causes the effects of it to remain in the habit so long after drinking, as to deter many from drinking it to the extent they otherwise would, to the no small detriment of its consumption. Half a pound of hops to every bushel of malt, is usually enough, but this depends in a great measure upon the time it is kept before it is tapped for use, and the season of the year it is brewed.

By a fermentation not sufficiently effective, this glutinous quality is studiously preserved, as if its adhesion, or stickiness upon the lips of the consumer, was alone intended to be the criterion of its strength, to the neglect of a lively spirituosity that should prevail in this ale, and prove the more rational criterion of superior quality and strength, and which would soon become conspicuous from its powerful inebriation, and more sanative qualities; recommendations not to be overlooked.

This, and a more perfect attenuation, would render Burton ale as strong and delicious as it is costly to the consumer, and infinitely more sound and healthy; therefore, instead of attenuating it to eighteen pounds per barrel only, it ought to be attenuated to ten or twelve pounds;

pounds; it would then be a very full-bodied, but not a glutinous, drink, with the advantage of being more than equally potent and salubrious.

It is presumed, that these observations will be sufficient to enable the reader, previously acquainted with brewing any other kind of malt-liquor, to brew *Burton ale.* To be careful in the choice of their yeast, and more liberal in the use of it; and to regulate the heat of the worts at pitching by the temperature of the atmosphere, always remembering, that the coolest time in the twenty-four hours is half an hour before sun-rise. *See bottling and flatening for Exportation.*

DORCHESTER BEER

Has been as highly esteemed, and as much drank out of the county as any country malt-liquor in England, as far as has fell within my own observation. It is an article prepared from good materials, that pays the brewer well; the *grist* was formerly composed of two parts amber, and one part brown malt, allowing full ten bushels to the hogshead of fifty-four gallons, beer measure. Latterly, many have begun to use some pale malt, in the proportion of one quarter to two of amber malt, entirely leaving out the brown; this enables them to draw a length of two barrels per quarter, of thirty-six pounds per barrel, specific gravity, which is nearly the standard strength of *Dorchester beer.* Most of the common brewers for sale wet from twenty to thirty quarters of malt at a brewing.

They mostly use half a pound of hops to each bushel of malt, and boil them too long for the good of the beer; this is in some measure

owing to sluicing the goods with too much liquor each mash, which obliges them to boil their worts much longer than they otherwise might, did they prepare each *mash* stiffer, a practice I beg leave to recommend, as it would save much of the volatile principle of malt and hops, which I have so often inculcated in this Treatise, that it is almost unnecessary to mention it here. The over-boiling of the worts in an open copper lays the foundation of the staleness, so conspicuous to strangers on their first tasting Dorchester beer, which the age of it, if properly cellared, could never induce, or be the cause of; it is long boiling promotes this acidity.

The beer is much better attenuated than most country beers and ales, to which it owes great part of its goodness; consequently it is more inebriating or heady, but proportionally less distressing the next day than much fuller bodied, but less spirituous beer or ales. Yet it is much improved by bottling. It is usually attenuated to fifteen pounds per barrel, and oftener to thirteen pounds. It would be stronger and better if it was attenuated to eight or nine pounds per barrel, and though not quite so full in the mouth would keep longer, without getting to be so over stale as we generally find it, as spirituosity counteracts acidity.

They usually take their *heats* too low, probably from being in the early habit of using more brown than amber malt. Now they are getting into the use of amber and pale malts only. I recommend one hundred and sixty-five degrees, for the *first mash*, and one hundred and seventy-five degrees, for the second; and not to grind their malts too fine. To keep their beer oftener filled up while on the stillions, and for a shorter time than at present; to *pitch* with good live yeast, and regulate the heat they pitch at, according to the season of the year; and if they brew in the warm season of the year, to bring their worts together half an hour before sun-rise next morning, it being the coldest half hour in the four and twenty; should they improvidently slip this

opportunity

opportunity, (in hot weather) their beer will never be perfectly fine, nor free from acidity. *See Bottling and Flatening Malt-liquors for Exportation.*

WINDSOR ALE.

This is a very pale, light, spirituous, agreeable, ale, as fine as wine, called in Windsor the *Queen's ale,* unquestionably the best fermented of any sent to London, where fifteen thousand barrels annually comes to market. *It needs no other recommendation.* The practice of brewing it is a good mode of work for pale ales.

THE PROCESS OF BREWING FOR ALE.

First Mash. Having from twenty to forty or sixty quarters of the best *pale malt,* of the specific gravity of from eighty to eighty-eight pounds per quarter, ground moderately coarse, ready in your *mash-tun* at least from twelve to twenty-four hours before mashing, and your *first liquor* at from one hundred and eighty-two degrees, to one hundred and eighty-five degrees of *heat,* turn on a quantity proportioned to the number of quarters you *wet,* and the *length* you propose to draw; for instance, at the rate of obtaining three barrels per quarter in three *mashings.* You should turn over near two barrels of liquor per quarter the *first mash,* and but one each of the succeeding mashes; but if you draw but two barrels and a half per quarter, at the rate of a barrel

a barrel and three quarters per quarter will be sufficient for the first liquor ; and one barrel per quarter each succeeding mash, is as little as can be well dispensed with in three mashings for *short liquors,* and *stiff mashings,* and to have as little as possible to evaporate in the copper, on account of the *short boiling* I have so strongly recommended. Which *mash quick,* and do not suffer the *tap to stand* above an hour, or less in *warm weather,* nor to be too long a *standing* after it runs fine, as the whole should be completed within the compass of two hours, and every thing in readiness to commence the *second mash* within that time.

Second Mash. Take your *second liquor* at the *heat* of from one hundred and eighty-eight degrees, to one hundred and ninety-two degrees, if the slackness of your malt admits of it. Mash quick as before, or as much quicker as you can, and do not let the *tap stand* above three quarters of an hour, or a quarter of an hour less in *warm weather,* and let it be proportionally short in *spending* after it runs fine.

Third Mash. Let the third mashing be shorter still, and do not let the *tap stand* above twenty minutes, or half an hour at most. Here the *heat* of your *liquor* need not exceed one hundred and sixty degrees at most. A fourth liquor at a low temperature, or even cold, may be *turned over* the goods, to obtain the small quantity of remaining gravity or strength.

If the three first liquors are *turned under* the goods, let this last be *turned over* them, and do not mash or otherways disturb them, and when the *tap is set,* the supernatent liquor will cause the wort to descend and run off unmixed with the liquor *turned over,* which will replace it; by which means it will be much stronger, and the *grains much weaker.* On the *standing* and *spending* of the *tap,* together

together with the *boiling of the worts,* there has already been enough said, to which I beg leave to refer.

COOLING THE WORTS, AND PITCHING.

If the WORTS *are not properly* COOLED, if they are *pitched too high,* or if they are not all brought together at nearly an equal temperature, and that temperature not under fifty-two, nor above fifty-eight degrees, or at most sixty, much difficulty may occur in that important part of the process of *fermentation,* to the very great injury of the subsequent drink, an evil to be apprehended in proportion to the *warmth of the weather* the gyle is brewed in, as the *fox* (as it is called) is most likely then to creep in, and overturn all the previous well-managed business; a danger only to be avoided by *laying the worts very thin in the coolers,* and pitching at the coolest time of the night, which is half an hour before sun-rise.

A difficulty and danger to be encountered with, by those who brew in *Summer,* more frequently than by those who brew in *Winter* or *cold weather,* and a very serious thing it too often proves to the *pale* and *amber brewer,* and can only be surmounted, or overcome, in the way we propose. In *Winter,* and while the temperature of the atmosphere is at about forty degrees, and from that to fifty-two, we can venture to lay the worts in the coolers from two, three, or four, inches thick. In *Summer,* and during the warm weather, when the temperature is from fifty-five to seventy-five, or eighty degrees at mid-day, we cannot lay them at over an inch, an inch and an half, and from that to two inches thick in the coolers, nor perhaps, be

be able to *pitch* until half an hour before *sun-rise* the next morning after we have brewed, which is, as we have frequently observed, the coolest time in the twenty-four hours.

At which time all the worts will be the nearest they possibly can be, at the same temperature; and the incumbent air of the atmosphere at the greatest possible coolness. If you have not my *cooling attemperator,* the advantages of which are enumerated under that head, *beware how you lose these moments in warm weather!* they come but once in the four and twenty hours, and if you suffer the worts, that ought to be *pitched* then, to lay, your whole gyle may be lost, and the *fox* introduced to your future annoyance and loss. The moment their temperature changes from the greatest coolness obtainable at that critical time, the *seeds of acidity are sown.* Though you should escape the *foxing of the gyle,* or a *greyness* of the *malt liquor,* which last is not a very curable evil; should you escape all these evils, yet you will not be able to get the yeast out of your beer or ale, of which they will always taste; particularly if your worts were over-boiled, and rarely be perfectly clear.

Pitch with good sound live yeast, letting part of the strong wort down first, to take hold of the yeast before the whole are brought together in the tun, and brought as near as possible to fifty-eight degrees of temperature in hot weather; and let the rest gently down to it, as near the same coolness as you can, so as not to *drown* or *smother* the yeast, or the *attenuation* will not go kindly on at best, and you may have a *grey,* if not a foxed or *sour gyle.* One or other of which owe their existence not unfrequently to the worts undergoing a change of heat, or a turn, as it is called, in the coolers.

Grey beer more generally owes its existence to an over heat on the *floor* of the malt house, that is, in the *heap* when the barley is *malting,*

and

and not unfrequently to an error in *steeping*; in both cases it is *a defective separation of the animal gluten of the grain*; though sometimes created in *mixed grists* during the brewing, as before observed. it may be often owing to the vile practice of *wetting or damping the malt in the barge*, layer after layer, as it is stowed away. This is done with a view to make the malt apparently heavier, or to allow for its loss of weight in the carriage from the maltster to the brewer. However this is a subject we shall quit for the present, leaving the discussion of it to another place at a more convenient opportunity.

The *System* laid down under the form of a Table, it is hoped will prove an easy, safe, and effectual *Rule of Practice,* sufficiently apparent to be fully comprehended by the plainest understanding. See Table IV.

This table, although by no means as extensive as it might have been, opens a very plain comprehensive *book of knowledge* to the experienced, as well as the inexperienced common brewer. It brings his day's work into one view, with all its advantages and all its errors, and is a standing rule of comparison for his future brewing, by which he may find out the *tares,* and *weed* them from the *wheat.*

By it he sees the value of the malt from which he brewed, the preference and price he ought to give; how much longer or shorter *length* he may safely draw in future from such goods; how the *heat* of his *liquors* do, or do not correspond with the quality of his *grist*; where an advantage, or disadvantage has, or may occur, and how to obtain, or avoid it; in short, it is the *golden rule of practice in brewing.* Faithful as the compass to its polar direction, it points out the course he ought to steer.

In order to return and finish the *process*, we must observe; first that in or about forty-eight hours, or from that to sixty, the gyle of ale will assume a *close head of yeast*, which should be carefully skimmed off, as fast as it forms. By this is not meant the first, or *worty head*, formed soon after the yeast takes hold, which would drop to *beer* or *ale*, *but the close yeasty head above mentioned.*

When no more yeast rises, and the gyle of ale remains quite flat in the tun, you will find that the heat you pitched at of fifty-six, fifty-eight, or sixty degrees, is increased to about eighty degrees, or even somewhat more, and the gravity *decreased* to six, seven, or eight pounds per barrel, which was from twenty-five, to twenty-seven pounds specific gravity per barrel, at the *pitching* or commencement of the *attenuation*.

Both the *heat* and *gravity* should be daily attended to and noted, as in the table, for the present and future government of the brewer, in conducting the *process* with certainty and success.

When the *heat* is at a stand, or when the attenuation has proceeded thus low, *cleanse*. When attenuated so low in the tun, it will work but very little on the *stillions*, but must be kept *filled up* every two or three hours, as found necessary, from sixteen to twenty-four hours. When it should be *started* into a *close air-tight vat*, with about a pound of hops to each quarter of malt used, or a pound and an half, taken from the *hop back*, after the boiling of the first worts. Here it should be allowed to remain and *depurate* for a fortnight at least, in which time, or less, it will have dropt fine, bright, and sparkling, and fit to be *racked off*, and sent out. Where it may remain until used, without any danger of *fret*, *rising*, *or sickness*, much longer than ale is usually kept before drinking; improving by age in flavour, quality and complexion, so as to give the highest satisfaction to the customers.

The

The *hops* taken from the boiling of the hop wort, out of the hop back, and *lightly dried,* to prevent their souring before the *starting* of the gyle into the vat, is much better than the same quantity of *fresh hops,* provided they have been but *lightly boiled,* as directed under that head, from the quantity of *rich wort* attached to them, which will promote *briskness.* We should recollect, that every sixty pounds of hops takes up a barrel of worts, as before observed; the substance of which they will hold, though dried, provided they are not too much dried, as then the extract they contain would fall to dust, and be partially, or wholly lost; as they might be more or less tossed about before added to the *gyle of ale in the vat.*

If the worts are boiled in the old way, *fresh hops* have a decided preference; then they should be deducted from the original quantity allowed for the whole gyle, and reserved to be added at *starting. Fresh hops* should be wetted with some of the *ale,* before they are put into the vat to the rest of the gyle. If there are more gyles than one started in the same vat, make use of fresh hops, instead of those boiled in the first worts.

SELECT OBSERVATIONS.

Boiling the Worts, a subject little understood, therefore not duly attended to, so that but a very small part of this ground has been pre-occupied by former observers, though undoubtedly there is scarcely any of so much, or at least of more importance, in the whole process of brewing, if we except *fermentation.* Indeed, there is none of the operations in this process that admit of want of care and atten-

 tion,

tion from the *malting* of the *grain* to the *starting* of the *malt liquor* brewed into the cellar.

For, if the best malted grain, and the best cured hops, do not always secure the best and most profitable *malt liquor*, even in the hands of an expert brewer, how many advantages must be overlooked and lost to an *inattentive operator*?

The *heats* at taking the *liquors* are very important; an accurate knowledge of which, when a *slack* or a *sharp* liquor is, or ought to have been applied, enables us not only to avoid, but to correct errors when they happen through mistake, or neglect, and at all times to insure the best *extract* obtainable from our *grist*.

Great as these advantages are, they may be more or less counteracted, or even lost to the brewer, from inattention, or a want of fully comprehending the subsequent operations of *mashing*, standing of the tap, boiling the worts, &c. The mere blending and incorporating the liquor with the grist, though indispensibly necessary, is not sufficient, if it is suffered to stand too long, or too short a time on the goods; hence the standing of the tap is a matter of more serious consideration than is generally imagined.

The error most frequently committed in this, as well as in *mashing*, is, in expending too much time on both. Too long mashing unnecessarily cools the goods, imbibes a greater portion of the liquor, and impregnates the worts with the air of the atmosphere, which is sowing the seeds of acidity in the future gyle, and that in proportion to the heat of the weather. Subsequently, the long standing of the tap materially contributes to, and at the same time renders the growth of that acidity perceptible to the taste, even in the second mash, where it is not so much covered by the richness and sweetness of the saccharine part of the malt like the first wort; *in the spending*

spending of the third tap it becomes (after long standing) discoverable to the very sense of smelling.

Mashing, or the incorporating the liquor with the grist, should be understood the infusing the malt in two or three portions of liquor, to extract all the farinacious or mealy parts from the branny earthy ones, in order to compose one uniform gyle. The *stiffer the mash* the freer the tap will spend; and with the assistance of a properly adapted heat, the more perfect will be the solution of the meal, or flour of the malt, and the brighter the extract will run from the goods; the sooner it will break in the copper, the less time it will require there, and the earlier it will be in a transparent and drinkable state.

Great quantities of malt, it is true, cannot be so expeditiously mashed as twenty or thirty quarters, though with many hands, or even where a *mashing machine* is employed, particularly where short liquors are taken, as recommended by *stiff mashes*, yet the prolonging it can always be avoided; and the standing of the tap need never be unnecessarily long; therefore it is an error we can and should correct, as far as it is in our power. Twenty minutes or half an hour may be allowed for the first mashing; when it can be completed in that or less time, so much the better. An hour, or an hour and twenty minutes, and from that to an hour and an half, in cool weather, for the standing of the tap; that is, from an hour and an half to about two hours, for both mashing and standing of the tap, including the time the tap is spending; as the tap may run with a stronger stream from a stiff mash, than otherwise, and still be finer. The time allowed to the second mash and standing of the tap should be less, and to the third considerably less, and yet the extract shall be richer, and the grains more branny and drier than when more time is unprofitably wasted, to the manifest injury of the gyle, provided the heats of the liquors are adapted to the nature of the grist. Pale malts yield more

kindly

kindly and quickly than higher dried malts, therefore require less time for mashing, &c.

The slacker the liquor, the more weyish and less transparent the wort, but the fuller and sweeter; the sharper the liquor is taken, allowing for the nature of the grist, the paler and more transparent the wort will be, at the same time leaner and less mucilaginous; and as the former exhibits the grumes, or curdy fleaks, sooner, larger, and in a greater quantity in the copper, so the latter produces them smaller, and in less proportion. The liquors, if taken too high, may materially influence the *fermentation*, though we should be so lucky as to escape coagulating the goods, or making a pudding, as it is called, or in the protracting the free spending of the tap. The pitching too high, though cleanliness may prevent *foxing*, the attenuation will not succeed so well.

It is a good practice, where it can be done, to break up the hops either in the under-back, copper-back, or in the copper, to infuse for half an hour or so, while the fire under the copper is damped up, to wait for either the whole or part of the second wort being pumped up into it, before the boiling of the hop wort commences, as is usually the practice with the common brewer, who generally makes two boilings of the three worts. Where the cooling surface admits of it, three boilings would be more advantageous and commodious, giving more time for cooling the worts.

As for the worts themselves, we have already seen that, provided the liquors were taken sufficiently short to admit of it, (and to which purpose they always should be accommodated) the less boiling they get, the better and fuller bodied will the ale or beer be, and at the same time the less heavy, gluey, and sizey, and more light, rich, and spirituous, as well as grateful and fragrant; indeed their excellence, in some measure, depends on a *due infusion* of the hops, and *short boiling*; the less sediment there will be in the coolers, the less lees in the gyle-

gyle-tun, and the less grounds in the stillions, the vats, and the casks; and consequently the less waste of every kind, and greater quantity of ale or beer from the same quantity of extract, that will be sooner transparent and drinkable, and of a better quality, without the danger of rising, fret, or sickness, on change of weather, and always to be depended on for dropping fine soon after moving, with the advantage of saving time and fuel, provided the worts are pitched sufficiently cool. The longer it is boiled, and the larger it granulates from the continuance of the boiling, the more it will be subject to the reverse of all these desirable qualities. I must add, that long boiling gives a high colour, and is therefore so far injurious to pale ale.

The time of *breaking*, or, as it is called, the *criterion*, is so uncertain, it sometimes appearing in a quarter of an hour, at other times taking from one to two hours, as the malt is more or less slack, or the liquors taken slack or sharp, that is, according to the adjusting the heats; to the newness or oldness of the malt, and mode of making up the grist; which is always reckoned difficult in proportion as it is composed of malts varying in colour and quality, a difficulty very easy to be obviated, where there are two or three mash-tuns, by brewing each separately, and mixing the worts instead of the malts. For overcoming this difficulty I have laid down a certain rule elsewhere. See *Standard Heats*, under the head *Porter*. The sinking of the hops is no criterion either of their virtue being extracted, or the worts being sufficiently boiled.

It may be inferred from these observations, that *boiling the worts* might be dispensed with, provided the essence of the hops were obtainable by infusion, which all the desirable parts certainly are. Though very well assured that it might, I by no means recommend a practice so contrary to general rule and the established opinion of the trade, not thinking it safe to attempt the introduction of so great a novelty in the art of brewing, as it might be made use of as a handle

by

by those who could not brew so good an artical by the *old* process, to condemn in toto the *new*. Much as I recommend short boiling, let it be remembered that the criterion cannot be dispensed with, as no man in his senses would discontinue the boiling before the worts broke in the copper.

The brewing a few gyles of ale and porter exactly by those well-founded plain instructions, will not only prove their excellence, but may enable the brewer in future to draw as great a length from nine, as he previously did from ten quarters of malt, equally strong.

It may be expedient to observe, that the grumous matter which curdles and breaks in the worts, abundant in proportion to long boiling, as may be seen and judged of in the coolers, chiefly consists of the mealy mucilaginous parts of the malt, that gives fullness and body to the drink, together with the grosser, bitter parts of the hops. Let me here observe, that this breaking of the worts, so variable in itself, and the time of its appearance, from the different circumstances of the malt, the degree of heat the liquors are turned on at, &c. as for instance, it appears sooner, and in larger grumes or flakes, in *old*, than in *new*, *malt*; slack dried malt exhibits its grumes or flakes sooner and larger than high dried malt; the grinding coarse or fine, the length of time between grinding and mashing, even the nature of the soil on which the grain is grown, is found to diversify the appearance of breaking.

The full vegetated pale dried malt contains much the largest portion of this mealy mucilaginous matter, gives the greatest gravity to the worts, and therefore yields the richest gyle and greatest *length*. The browner and higher dried malt yields proportionably less. Then, let me ask, where is the utility of purchasing at the highest price, the palest and best malts, and the choicest and best hops, if we lose the end for which they were bought, by long boiling, over standing of the

the tap, &c.? then why suffer the long application of a short boiling heat, momentarily accumulating from the increasing gravity of the wasting worts, in proportion to the evaporation of the decreasing fluid, to coagulate and char these essential parts of the materials, on which depend, in a great measure, the goodness of the *ale* or *beer* produced.

KINGSTON ALE.

There are two sorts of ale brewed at Kingston, a pale and an amber, much about the same degree of strength as the *pale* and *amber ales* brewed in London, to which market a considerable part of those ales used to come. I have seen ten quarters of their pale ale brewed as far as the *second mash;* there were eighteen barrels of liquor turned over the first, and twenty-one the second mash; the first liquor at one hundred and seventy-eight degrees of heat, and the second at ninety. *Not being able to attend longer*, from a necessary attention to other business, I took the following account of the process from the brewing book. Sixty pounds of the best Kentish hops to ten quarters of pale malt, ground in a medium way, were the materials employed.

The heat of the weather forty-eight degrees; the hops were boiled for two hours with these two worts, and cooled to fifty-eight degrees; the specific gravity was twenty-four pounds and an half per barrel; they were pitched with four gallons of good yeast on Friday evening; on Saturday night, at eleven o'clock, had passed the worty change; roused her that same night, and at nine o'clock on Sunday morning, heat sixty-eight degrees; the same on Sunday afternoon at two o'clock; ditto at six o'clock the next morning; and at eleven o'clock

night; on Tuesday morning at six o'clock found her coming to her stomach, heat seventy-three degrees; skimmed at eleven o'clock, and put in one pound of salt and two pounds of wheat flour; roused her well up, and let her lay till one o'clock; skimmed her again, and put in one pound of coriander-seed; at five o clock in the evening found her gravity but six pounds per barrel, and the heat seventy-four degrees; cleansed into twenty-six barrels; filled up every three hours for eighteen hours; the ale worked a little in the casks for two days; stowed away twenty-four barrels in all.

For Table Beer—*Third mash*, capped the goods in the mash-tun with a quarter of amber malt for table beer; turned over twenty-six barrels of liquor at the heat of one hundred and fifty degrees, let the tap stand two hours, then set tap; boiled this wort with all the spent hops for an hour and an half, * the quantity tunned twenty-three barrels, at ten pounds and three quarters specific gravity per barrel.

WELCH ALE.

There are as good, and probably as bad, Welch ales as ever were drank. The ale exported from *Wales* to *Ireland* is excellent, brewed from good pale malt, and of about the strength of *Windsor ale*. They have a higher coloured, pleasant, sound ale, brewed from equal parts of amber and pale malt; there is not near the quantity of this exported; it is not quite the strength of the former, but somewhat similar to our best *Kingston ale*, which was frequently drank in *London*.

These

* Cleansed the table-beer at six o'clock, on Saturday morning, cooled to sixty-six degrees, and pitched with one gallon of yeast.

These two sorts of ale are always remarkably fine, and mantle in the glass; a quality they are so careful to preserve, that, to secure it in the former, they put *finings* in the copper, and in the latter add them in the gyle tun. They are both commendable qualities in malt liquors, but not the most frugal way of obtaining them; yet they are certainly right to make sure of them. They have one invariable rule of putting into every barrel of ale a quarter of a pound of hops, moistened in some sound old ale, at the bunging them down; this is a very commendable practice.

SCOTCH ALE.

This potent malt liquor might be one of the most excellent, was it better fermented and longer kept before tapped; properly flattened when bottled, and never thought of being drank until eighteen months or two years old. *Scotch ale* managed in this manner, would be the strongest malt liquor brewed, (German mum not excepted) and not the least wholesome, from the quantity of *raw-corn* employed in its preparation.

Their reply is, "When we over-ferment our *Edinburgh ale*, it loses its glutinous fullness and gets sour into the bargain." This I beg leave to remind them is caused by not considering that raw-corn, not having undergone the process of the vegetative fermentation, called malting, should be *malted in the gyle-tun*, as recommended under that head, when urging the advantages of using raw-corn, where may be seen what I have said on that subject.

 Should

Should I at any time brew Scotch, Burton, or any other very strong ale, in which I made use of raw-corn, I would brew the raw-corn by itself, watch its increasing gravity, and when it became stationary, or at least as soon as it began to decrease, add my malt-worts, so contrived as not to have long commenced fermentation, which might be more easily managed than the generality of common brewers will readily allow; as raw-corn will take three or four days from the time the worts are extracted before sufficiently fermented to be blended with the malted worts; a thing very easily managed by those who will set heartily about it, and provide themselves with a second gyle-tun, &c. things that most brewers are seldom without.

I know malt-distillers who brew an excellent table-beer from raw-corn; they know the value of raw-corn. The worts of raw-corn require a great deal more yeast than malt worts, and a repetition of it. Nothing can go on better in the attenuation than the two worts when brought together in the gyle-tun, in the manner proposed, and, perhaps a better malt drink cannot be produced than can be made in this manner. *See flattening Malt Liquors for Exportation.*

IRISH ALES.

Until the late progress of improvement in brewing in that kingdom, the generality of malt liquors were not remarkably good; the *Wicklow ale*, some few others, and home-brewed ales, excepted. There is no country, if we except *Spain*, in which the nobility and gentry have set the commonalty a better example, or made greater exertions to inspire industry and a taste for agricultural and useful pursuits than in *Ireland*.

That

That excellent, and judiciously conducted Institution for the encouragement of agriculture and arts, the *Dublin Society*, have spared no pains in propagating useful knowledge, in whatever seemed to them likely to enrich the inhabitants and increase their prosperity; perhaps in none more than in *brewing*, well knowing that good substantial malt liquors were better able to sustain the arduous efforts of the labouring part of the community, than the immoderate use of spirituous liquors, that had gained ground to the manifest injury of the morals of the lower order of the people. The journals of this respectable society, and the suggestions they published to promote these ends, the culture of barley and hops, the malting and curing of each, and the method of obtaining a substantial wholesome beverage as their ultimate produce, have merited the praise and attracted not only the attention and imitation of *Great Britain*, but neighbouring nations.

Dublin Ale, though a clean sound article, with a tolerable good face to recommend it, was much too thin and light, to be sufficiently nutritious for hard working men; faults too applicable to many of their malt liquors for sale, and which were a strong incentive to the decided preference given to cheap ardent spirits.

About thirty years ago, the well-intended but too hastily adopted resolution of gentlemen to discourage the importation of foreign spirits, and curb the prodigious consumption of foreign wines, by setting the example of drinking *whisky*, a malt spirit of their own produce, instead of raising the duties on all these articles, and converting part of them to bounties for encouraging the production of good malt liquors, was so readily taken up, and imitated by the labouring part of the public, as to prove a constant source of evils bordering upon, or at least clothed in, the garb of profligacy.

All other kinds of exhilarating beverage, and cheerful sociality, giving way to the abuse of this liquor, either mixed or unmixed with water;

water; great and laudable have been the efforts of gentlemen to divert this current of imitation into the less destructive and more sober channels of a *strong beer* beverage; and such has recently been the progress of this diversion, that several brewers with their capitals, and other wealthy enterprizing people, have left this kingdom, since the union, to settle.

Brewing, now a favourite pursuit in *Ireland,* in which not only the capitals of many worthy men of their own country are embarked, in different parts of the kingdom, but of several others in this kingdom, so that it has assumed a most encouraging aspect, and is rapidly advancing towards perfection; we are in hopes such praise-worthy example, and indefatigable exertion, will be always crowned with the desired success.

WICKLOW ALE,

We must do them the justice to say, owes not its origin to any other efforts than the mere ability of the *Wicklow brewers,* and may be established as a proof of the capacity of the people, even in the country parts of that kingdom, to brew as good an article as is to be found in *any other.* I confess I am among the number of those ready to give them credit for so much, provided they have as good materials as those who now excel them.

The numerous entries in the list of their imports, are too many proofs of how much this, their elder-sister, kingdom excels them. Their capacity for improvement, the avidity with which they take it up, will, I hope, be equalled by their perseverance and industry,

dustry, to a commercial extent, and beneficial to the interests of the united kingdoms.

Some well-informed brewers, who have been invited from London, and placed at the head of very considerable breweries there, complain of the immaturity of the *Irish barlies*; this I am the more surprized at, as barley and hops have been an early care of the *Dublin Society*.

If the Wicklow ale is brewed from Irish malt, the same barley that produced it, I am of opinion, would answer their purpose for brewing *porter*, or any other *ale* required; but this I must not enter into here. *See Old Hock.*

It is more than probable, I should not have said so much of Wicklow ale, had I been as well acquainted with some other of the ales of Ireland. It is full thirty years since I tasted it, and speak on the ground of its being equally as good now; however, it attracted my notice so much then, that soon after coming through that country, I enquired into their mode of brewing.

THE PROCESS OF BREWING WICKLOW ALE.

They brewed with hard well-water, not having any other; for every barrel, wine measure, of transparent ale they intend to make, they took six bushels of very pale sound malt, ground very coarse, and two pounds of the best hops, which were boiled for two hours in the wort of the first mash, and for the same time in the wort of the second mash. They made the third into table-beer, in which were

were boiled the same hops for three hours; of this they generally made one barrel also.

They regulated the heats of their liquors in this manner: for the first mash they added one barrel of cold water from the well to every four barrels of boiling water in the copper, on the moment of its first ebullition; for the second mash, they took six barrels of boiling water to every barrel of cold water; this was in the winter months: I do not know the summer heats of their liquors. They *beat the yeast in*, and as soon as the second head fell, they *cleansed* into the barrels; filled up for sixteen or eighteen hours; put about an ounce of dry hops into every barrel, and bunged it but loosely down, leaving a spill in near the bung, to give it vent for a few days only, and then bunged it down close, leaving only a spill in the head, to know when it dropped fine, which was usually in a month or six weeks, and sometimes sooner; it was seldom sent to the publicans under six months, and some was kept longer before sent out. This generally proved to be a very pale, lively, brisk, spirituous, ale, of an inebriating quality, sparkling to the last, like bottled-ale, in the glass.

BRUNSWICK MUM, OR LUBECK AND ROSTOCK DOUBLE BEER.

* In the latter end of the sixteenth century, large importations of German beer were made from *Lubeck and Rostock, Hans Towns,* famous for their production of this article; so great was the trade of the latter place in it alone, that they exported eight hundred thousand barrels

* Dr. Edmund Hally.

barrels annually under the name of *Lubeck beer*. The city of *Rostock* contained two hundred and fifty licensed breweries. It is generally remarked, that the most considerable part of the *Duke of Macklenburgh's* revenue rises out of the excise on the beer brewed in that city, which of course belongs to him. The strong *Lubeck beer* was a supersaturated extract of malt prepared in this manner. They used a larger proportion of water in *their first* mash than we ever do; after it had stood an hour or two on the malt, it was drawn off and heated to the boiling point, against which time, they had ready mashed in another tun the same quantity of fresh malt, with no more water than what barely wets it *, that had stood about an hour, over which they poured the first wort, then let the second tap run gently, pumping up the mixed worts until they came down very fine; this supersaturated wort, or double extract, was boiled with a large proportion of hops for two or three hours or more, into the glutinous substance, called *mum*. This extraordinary rich *Lubeck beer*, but half fermented, was tunned up and stored for sale. A second beer was then drawn in a similar manner from the same goods in each mash tun, which, though weaker and leaner than the first, made a kind of strong harsh beer. The wort of the third mash, prepared in the same manner, was their table drink. This process accounts for the similitude between *mum, Lubeck, and Rostock beer, and our Burton ale*. The process of brewing mum has always been kept a secret, foreigners not being admitted to see them at work, and the men engaged in it (as I am informed) hired for life. From the experiments I have seen made to ascertain the gravity of a first wort prepared by supersaturation, and boiled with a proper quantity of hops for two hours, the specific gravity per barrel was about sixty pounds, when two mash tuns and two grists were employed; and did not come up to seventy pounds when three grists were used. In those countries where *additions* are not

* This is what I call a *stiff mash*.

not prohibited, one mash tun and one grist is fully sufficient, as the gravity can be subsequently increased in the copper or gyle tun, by molasses, sugar, &c. to a much greater extent than ever can be wanted, an advantage from which the English brewer is ridiculously prohibited by absurd laws, framed without a knowledge of the subject. *See Made Wines.*

FININGS

Is an article of considerable importance among the brewers; with the porter brewer it is of such general use as to be almost indispensable. It is prepared with isinglass, and an article in the trade called *sours,* usually made with the weak wort of the fourth mash, and is used in such quantity by some as to brew a whole gyle of weak worts for it. In every way it is prepared, whether from malt, sugar, or other saccharine matter, the object is to have it as sour as possible, finding that the sourer it is, the better it *cuts* their glass, that is, the better it dissolves the isinglass; the general method of making *finings* is, to either first beat the isinglass and pull it into shreds, or to soften it in the acid liquor, and then pull it into shreds, to expose it in a greater surface to the action of the sours. Even this is sometimes dispensed with, and the isinglass is steeped whole in the souring medium, in an open vessel, and occasionally stirred about until dissolved; the proportions are, from a quarter of a pound to six or eight ounces, or more, of the isinglass to the gallon of sours; whichever way it is done in, it is generally found that a pint, or somewhat more, is enough, according to the extent or obstinacy of the foulness; but some use it in larger quantities. Many brewers fine their beer as they send it out, others at the publicans, and some at both; all of them

send

send the cooper round among their customers to know what is wanting, and to see the state the beer is in, and know what *mild* or *stale beer* is wanting to make up, or draw with that in the house. *The finings* are diluted with sours by others before it is carried out by the man employed in this part of the business: all these things are according to the customary usage of the house; and there can be little or no use for descending further into particulars, *which the brewers will not scruple to allow;* except it is worth remarking, that isinglass has the excellent properties of correcting the acrimony of the animal juices, and promoting the termination of obstinate venereal disorders. As a *fining substance* it requires to be well blended with the liquor to be *fined,* the agitation exciting an intumescence it will require the bung to be left out, until it falls or goes down again. It operates on the foulnesses in the liquor in this way, the grosser particles of the finings commix and unite with those gross lees floating in, and interrupting the transparency of the fluid, and precipitate with it to the bottom; the finer entangling the lighter particles, and ascending to the top, forms a head, or covering there, by which means the liquor becomes transparent and bright. The publicans are well acquainted with this *head,* which descends as the liquor is drawing off, until it comes to the broadest part of the butt, where it becomes too thin to adhere longer together, breaks, and is seen in gross particles floating up and down in the pot, but usually all descends in the course of a night, leaving the liquor transparent as before. *See Finings, in the Appendix on Foreign Wines.*

SPRUCE

Is a therabinthinate juice, or extract, prepared from the young shoots and toppings in spring, and the cones in autumn, of the red,

 yellow,

yellow, and black, fir-trees, which are *ever-greens,* growing in the northern parts of Europe, Asia, and America; those in the more southern parts partaking still more of the therabinthinate quality, verge upon the common turpentine flavour, and are consequently more heating, stimulating, and unfit for a *cooling draught,* although, at the same time, a sweetener of the blood.

It is prepared by coction, until the water is saturated to the consistence of treacle, or thin honey, and then called essence of spruce, and packed up in pots, bottles, or casks, for use. The bark and softer part of the young shoots and toppings wholly dissolve; the bark of larger limbs of the tree, but partially, make a coarser kind. Both are decanted off, or strained fine for use from the indissoluble parts or dregs. A solution of any of the natural or prepared *sweets,* with a due portion of *spruce,* makes *spruce-beer, spruce-ale,* or even *spruce-wine.* Dilute solutions of molasses is generally employed; but sugars of every class are still better; honey is excellent; and weak extracts of malt make a very neat spruce-ale, or spruce-beer. In proportion as they are weak, more molasses may be added; if not, the fermentation should be proportionally shorter; the fermentation is interrupted by *cleansing,* or *racking;* and as soon as the yeast is worked out, it ought to be *bottled,* in the bottles usually prepared for *spruce-beer.*

Spruce-beer.—The ordinary spruce-beer so much in use, is made with molasses and spruce, in a very small proportion to the water used; some employing only half a pound of molasses to a gallon of water, and a pound of the *essence of spruce* to twenty gallons of spruce-beer; this slightly fermented with a little yeast for two or three days, is bottled, and corked up the next day, or the day but one after; and packed in saw-dust or sand, according as it is wanted to be used, sooner or later. In winter time, or in a cold climate, the water will require to be heated to sixty or seventy degrees of Farenheit's thermometer, according to the intensity of the cold, and to be kept

kept where it will not descend below fifty or sixty degrees of heat, until the fermentation gets sufficiently vigorous to resist the circumambient cold, which may be always judged of by the apparent strength or vigour of the fermentation. In proportion to the coldness of the atmosphere, increase the quantity of yeast; in hot weather, or in warm latitudes, very little ferment is required. For brewing in cold countries, the yeast should be carried in bladders, casks, &c. in such ships as intend to brew their own spruce-beer. In warm countries, a little palm-wine, or cocoa-nut liquor, will excite a vigorous fermentation, much more than is at any time required for spruce-beer, or any other spruce liquor, although they should be twice as strong of the molasses, or fermentable matter, as the above.

Spruce-wine may be made with three pounds of honey, or three pounds of Jamaica sugar, and one pound of *starch,* to every two gallons of water used; this will be a fermentable fluid of sufficient specific gravity, and stronger in proportion to its gravity, than either four pounds of honey or sugar alone, the starch agreeing so exceedingly well with saccharine matter as to increase the spirituosity of the attenuated fluid in a greater degree than the same quantity of saccharine, or the fermentable matter separately. The starch must be reduced to a transparent jelly before it is blended with the saccharine matter, by boiling it with part of the water of fluidity, reserved for that purpose; and should be pretty fully attenuated; and bottled as soon as the fermentation is perfectly over, in order to concenter a large portion of the carbonic gas to increase its activity and spirituosity. In this wine are united the medicinal qualities of the spruce to the cordial salubrity of the honey.

Malt-spruce. Table-beer, or small-ale, may be converted to *spruce-beer,* by ordering it to be delivered in the barrel as soon after it is tunned as convenient, and adding to each barrel one pound of essence of spruce, and molasses in the proportion of a quarter, half,

or

or three quarters of a pound per gallon, rousing them well into the beer with a long stick put in at the bung-hole, and agitating the cask; bottle it as soon as it has done fermenting, and corking it the second or third day after it has been bottled, taking care that it is fine before it is bottled. The Norwegians, Sweeds, Danes, and Americans, are not the only consumers of spruce in diet and medicine; the people of Devonshire, Cornwall, and Yorkshire, make a diet-drink of the spruce fir, or the common pitch fir of Norway, similar to the pitch pine of America, from whence they have been transplanted into Devonshire, Cornwall, and Yorkshire. The former, called by botanists, the *Abies terricori foli, fructa decorsum inflexo.* Turn. The common fir, or pitch tree; sometimes called the Norway, or spruce fir. The other, the *Abies taxi foli, fructu longissimo, deorsum inflexo.* Turn. The yew-leaved fir-tree, with long hanging cones, commonly called the long-coned Cornish fir, formerly brought from America. All preparations from spruce are warm, attenuating, and more or less stimulating and *antiscorbutic*; promote urine, sweeten and purify the blood and animal juices, cleansing and healing internal ulcerations, particularly those of the urinary passages; at the same time, like other bitter hot substances, strengthen the tone of the vessels, and are particularly good in gravelly and other calculous complaints, dissolving mucous, and promoting the expulsion of sand; in gleets and seminal weaknesses are good diuretics, and accelerate the cure.

Cherry-beer may be made in the same manner, by adding a few pounds of molasses, a pound or less of ground logwood, to each barrel of new table-beer, or small ale, with two ounces of almond-cake, procurable at the druggists. The medicinal qualities are in some degree opposite and greatly inferior to the spruce, the former acting both as an aperient and diuretic; the latter is diuretic, moderately astringent and tonic, good in laxity of the bowels, and for gently restraining habitual and other diarrhœas. In similar manner barley wine may be made.

BARLEY

BARLEY WINES

May be made of any quality, flavour and strength, in similar manner to the method proposed for making *cherry beer*; the red wines being coloured with logwood, elder-berries, black-cherries, or black-currants; forming a cherry beer, currant beer, elder beer, gooseberry beer, &c. On account of the barley white wines on one hand, and to avoid too much of the malt flavour on the other, only the palest dried malts should be used for these purposes. When intended for keeping, they should be brewed proportionally strong, and the colouring and flavouring ingredients added during the latter part of the fermentation. As there are red and black cherries, currants, and gooseberries, so there are white cherries, currants, gooseberries and elder-berries. The manner of making cherry, beer may serve as a specimen of the *red barley wine*. For making

White Barley Wine, take from six to twelve ounces of yellow saunders in powder, to every quarter of pale malt used, according to the *length*, and from four to six ounces of the almond cake for white cherry wine. Those ingredients are not to go into the copper, nor to be added until towards the decline of the fermentation, taking care not to delay their addition too long. This will make a most excellent malt wine, partaking of the pleasant smell, and bitterish aromatic agreeably pungent taste of this elegant wood. Observe, the white or red saunders does not possess those desirable qualities; the very smell of the yellow saunders is refreshing to the nerves of most people. A quarter of the hops usually employed in malt liquors will be sufficient, where logwood, or yellow saunders, are used. It is not so with respect to the fruits named. For further information see the Third Book, under *Made Wines*. The reader who may admire at my giving a process for preparing *red and white barley wines*, the former red cherry barley wine; the latter white cherry barley wine, and not making use of a

cherry

cherry in either, may (if he pleases) flavour the one with black cherries, and the other with white-hart cherries, and will then find, that neither of them will be more wholesome, nor near so agreeable, as those here recommended; or, what is still more admirable, possess so much of the cherry flavour! *Trial will resolve the problem!*

BREWING FOR EXPORTATION

Should differ in nothing from brewing for home-consumption, but in an *increase of strength, and decrease of attenuation;* whether exported in the *wood* or *bottled,* it should have age; the *flattening* should be proportioned to the length of way it has to go, except such part of it as may be consumed on the voyage.

The brewers in possession of the export trade, are in general provided with beer adapted to the purpose, which makes part of their stores; luckily it not being the practice to *attenuate too low,* should their stock prepared for this part of their trade be exhausted, their best keeping beer would, in many cases, answer this purpose, provided it had age enough. Other brewers, less extensive, meeting with an occasional order for exportation, and unprovided with beer of the proper strength and age, had much better have the beer or ale shipped from a respectable house in the export line, and take the *draw-back,* than hazard the exportation of an article that does not exactly correspond with the above observations on brewing for exportation, that might disgrace their recommendation.

When a brewer, unprovided as above, receives an occasional order in one season which is to be shipped the next, he may accomplish it within that time, and supply it himself, by brewing at a gravity of four

four or five and twenty pounds per barrel for porter, and seven or eight and twenty pounds for ale; and by attenuating the porter to ten, and the ale to twelve pounds per barrel, and *flattening* according to the subsequent rules.

Bottling. Weak beer and ale will not bear the *flattening* for exportation, necessary to any length of voyage, and if to a warm latitude would sour either before it got there, or soon after. I am speaking now of malt liquors in the *wood;* if in *bottle* it probably would *fly*. The directions to captains of ships, taking in beer for warm latitudes, should be to stow it away down in the hold in a *cool birth,* to prevent the gas or air, generated by the motion of the ship, being further expanded by heat, so as to endanger the cask. An iron nail, with a head as broad as a farthing, and a shank of the size of a quill, of an equal thickness throughout, and three inches long, should be loosely placed in a hole bored near the bung, which, by readily rising with the force of the air, will give it vent. Its length will prevent its being forced out, and its gravity cause it to return to its place.

Flattening. To do justice to the order, and credit to the brewer, there should be no beer exported under two years old, nor of less strength than here mentioned. In this observation I must not omit the *shippers,* who in general are people of respectability, and almost the entire venders of *bottled malt liquors*. I have drank bottled porter and ale with them that has been four or five years in the wood, and two or three in bottle, which, though highly prized by them, and very good indeed, was not so acceptable to me as some I have drank of not more than half that age. Malt liquors, like wine and cider, have their infancy, maturity, and decline.

Flattening in the Wood may be done in the intire butt, or store vat, or when racked into the casks it is to be exported in. What is

shipped

shipped for Scotland and Ireland is generally racked off in the rough from the lees in the store vats, and fined there. What is shipped for foreign countries, or our own settlements abroad, is commonly fined here, and racked from the finings, lees, &c. and then duly flattened for the length of time it is usual for ships to make their passage in, by leaving the bung out for three, six, nine weeks, or more; the casks should be sound, strong, and well seasoned. If flattened in the wood for bottling, it may be bottled one day and corked the next.

Flattening in the Bottle. Good bottles and corks are a primary consideration; the bottles sound, clean, and dry, of the wine-bottle shape, straight-necked, smooth and even in the mouth, narrowing very little about where the middle of the cork comes, to promote tightness; the best corks are the cheapest; leave an inch and an half space empty between the liquor and the cork in each bottle. Previous to the commencement of the bottling, the beer or ale, if not dropped fine through age, or if there is a want of brightness from any cause whatever, first *fine*, and then *flatten;* some trust to the porter fining during the *flattening*, if it is for any length of time; this may often happen when there is occasion for long flattening; but when it does not, it must be fined after flattening. *Fining* alone may be sufficient for short voyages, for fining is flattening to a considerable extent. When your beer is duly flattened, and perfectly transparent and bright, go on with the bottling, observing to cork the bottled liquor of the preceding day, and pile them in your cellar on their sides, as wine is stowed away, or put up in bulk or bins. Employ men accustomed to this kind of work, and enough of them at a time to dispatch the business out of hand. Dry winter weather is the best season for bottling; if immediate orders require it to be performed in summer, the cooler you can make the situation the better. It is a good practice to bottle in one day and cork the next, and the third day wire down the corks; you will then be able to see and re-cork any that weep at the cork.

Spontaneous

Spontaneous Flatness is obvious to every one at all acquainted with fermented fluids, as it happens every day through the carelessness of coopers' men, wine porters, and domestic servants, by leaving the vent-peg out of wine, cider, beer, or ale, when drawing from the wood; but it is not known to every one what this flatness arises from, as many well-informed authors ascribe it to the loss of spirits, whereas it is really the escape or loss of the carbonic acid gas, or fixed air, of the fermented fluid so *flattened*. Weak fermented liquors kept for maturity, having decomposed or expended all their fermentable matter, by insensible fermentation during their approximation to that state, not being able to recover themselves by the further emission of fixed air, being of a weak *stamina*, of course become vapid. Hence the necessity of *keeping beer* and ale, and beer and ale brewed for exportation, being prepared proportionably strong to the time they are intended to be kept, or the distance they are to be sent to. The reader, it is presumed, will, by these observations, see my motives for ordering beer and ale brewed for exportation, to be of a superior gravity or strength, and not to be attenuated so low, as I elsewhere recommend; as weaker beer or ale would not bear such long *flattening*, for want of stamina, or a due portion of fermentable matter to regenerate a sufficient quantity of gas, or fixed air, to recruit the exhausted spirits of the beer or ale flattened; and, consequently, could not get up in full strength and vigour at the time expected. Were this beer or ale shipped without due *flattening*, the continued motion of the ship, and the change of temperature from a cold to a warm climate, would cause the contained gas, and also that generating on the passage, to blow up the casks, and break the bottles to pieces, before the vessel reached her destined port. The liquor is known to be *up*, or fit for drinking, by the space between the liquor and cork being filled with froth.

It is hoped the brewers who have large store-cellars will draw as a conclusion from the above premises, the necessity there is for *air-*

 tight

tight vats, with a valve, or mode of suffering the escape of such gas only as would endanger the destruction of the vat, provided they wish to have a fine, spiritous, bright, and fragrant, beer or ale. By such means their beer, to the last few inches in the vat, may be preserved, so as to be as brisk and lively as bottled beer. They should provide the publicans (their customers) with a few of these valves for the butts or casks on draught; this would make the malt-liquors, now comparatively so weak and dear, as much better as would compensate, in a great degree, for both these disadvantages, and at once serve the public and themselves. In fact, something of the retributive kind is deservedly due to the public, both from government and the common brewer, who, to their credit, have born with unparalleled temperance the recent changes in quality and price in this necessary article of support to the labouring poor of the community as a domestic concern. As an article of commerce it is equally indispensible for the credit and continuance of our trade in this commodity, that its qualities should become an object of ministerial or legislative attention, that the consumers might have the best article the price of materials admit of, and the brewers a fair and full advantage from the great capitals they employ.

To evince the importance of the subject, it may be observed, that Sir J. Sinclair states, that from Michaelmas, 1787, to Michaelmas, 1788, the net produce of the perpetual excise on malt was 724,786*l.*; the annual excise, 604,317*l.*; the duties on beer, 1,666,152*l.* Mr. John Richardson makes the duties on malt, in the year 1784, to amount to 1,751,334*l.* 10*s.* 10*d.* to which, adding the duties on beer, for the same year, amounting to 1,932,272*l.* 7*s.* 11*d.*; and the duty on hops, 75,739*l.* 15*s.* 3*d.*; making in all the sum of 3,759,436*l.* 14*s.* For the last year, 1804, I make the gross amount of the duty on malt alone, 5,426,666*l.* 13*s.* 4*d.* as what it ought

ought to be, before the expence of *management*, or collecting, is deducted. The duties on strong beer and ale for the same year, 4,500,000*l.* The amount of the duties on hops for the last year I have not obtained; and if I had, it would not give an exact aggregate of the revenue arising out of the brewery, without deducting the duties paid on malt by the vinegar brewer, the malt distiller, and also the duties on the malt consumed by private families who brew their own drink, which are very considerable indeed. For the information of such readers as possess the curiosity of knowing the amount of revenue arising from the brewing of malt liquors by the common brewer, I will here give the aggregate of the duties on *strong beer*, and subsequently those on *table beer*. We have seen that the duty on strong beer and ale amounts to 4,500,000*l.*; if we add the duties on the malt consumed in making this strong beer and ale, 2,800,000*l.* the amount is, or ought to be, 7,500,000*l.*; to which add the duty on the hops consumed for strong beer and ale in the public brewery, by the common brewer, which amounts to 250,000*l.* the aggregate of the duties on strong beer and ale for 1804, will be 7,750,000*l.* taken in the gross, before the deductions for management, collection, &c. which, by my estimate, appears to be more than the net produce given by others.

The accurate reader cannot fail to observe, that the amount of the duty on hops, here computed to be used for strong beer and ale only, is nearly double what the whole of the annual produce is noted at, who may be, nevertheless, right. To whom it must appear a problem, the resolution of which I am not disposed to attempt, otherwise than by saying the duties have risen.

" The capital employed in the public brewery is *computed* to be more than 15,000,000*l.* and raises to government, exclusive of the duty on malt and hops, about 3,000,000*l.* annually; the brewers

therefore

therefore pay a very considerable proportion of the public revenue."* Twenty per cent on the brewers capital is no inconsiderable *tribute* to government, for leave to employ it in the line of their business; too much I fear to allow them to either reduce the price, or improve the quality of malt liquors for the people; yet fully sufficient to claim some attention from administration towards securing a good and wholesome beverage for the public, from the consumption of which they draw so large a resource. As the brewers very justly set forth in their application to Parliament,† they trust, that, in considering their case, it will not be forgotten, that their interest in this respect is the same with that of the poorest and most numerous part of the community, who must always be supplied by the public brewer; and that the public brewer, if his sale and profits be invaded by this excessive load of tax, from which the oppulent are exempt, must either increase the price, or diminish the strength, of the beverage of the poor. Here it ultimately falls upon the labouring poor.

The composition of the Grist, and Heat of the Liquor, were always primary considerations in the Art of Brewing; while the Length drawn has hitherto been measured by the *will* of the brewer, which the *public* are ever sure to call the scanty standard of the brewer's conscience, more or less qualified by the taste of his customers, and other local considerations, as fluctuating as the price of grain. The duties levied have been always regulated by the exigences of the *State*, with scarcely any view to the health or accommodation of the people, if we except such as went to guard against frauds in the Excise, or regulating the gauge of measures; and the 23d H. viii. c. 4. s. 5. against the brewers raising the price, which was done

* See the application of the Brewers to Parliament, during the administration of Mr. Addington.

† See their petition to the House of Commons.

done away by the 2d G. iii. c. 14. s. 1. and some idle prohibitions against various *additions*, few, or none, of which had any material foundation in fact; and many of which it would have been more beneficial to society, and conducive to the health of the people, to have either winked at or allowed; but we generally condemn what we do not understand. In the administration of Lord North there was some little done towards establishing a rule for making an *entire gyle Table Beer;* by the 22d G. iii. c. 68. "Table beer was never distinguished from strong beer or ale, in respect to the duties, which discouraged the brewing it of a moderate strength; to promote which it became expedient to make some attempt to proportion the duties to its value. The duty was settled at three shillings per barrel on table beer above six shillings price, and not exceeding eleven shillings, which, with the duty, made it sixteen shillings per barrel. By the 33d G. iii. c. 23. s. 1. after which it was called sixteen-shilling beer."

Previous to the present reign it was too much the practice to draw the Table Beer after the two first worts were extracted from the malt, for making strong beer or ale, as may be seen under *Kingston ale;* which was done by *capping* the goods in the mash tun with some fresh malt to lengthen it out—a very unfrugal injudicious practice. The smaller class of *London brewers*, especially those who brewed ale and table beer, either continued this practice, or were brewers of porter also, and applied the weak wort of the fourth mash to sours and six-shilling beer, and but rarely put over fresh malt at any subsequent brewing.

TWOPENNY.

TWOPENNY.

Twopenny and *porter* was formerly retailed at three pence the pot, until the rise of the latter to three pence half-penny, at the beginning of the present reign, when the price of the former, to prevent the fraction in paying for pints and half-pints, so frequently occuring from its much greater consumption among the old women then, was charged at four pence per pot, and being mostly sold by the pint, got the name of *twopenny*. It was brewed with rather lower heats, and much less fermented than the *porter*, which made it fuller and sweeter to the palate—a recommendation no doubt to its principal consumers, as those faults in its preparation made it appear stronger to such bad judges. Therefore, what is subsequently said about the *porter* with respect to the grists, is in a great degree applicable to *twopenny*. For the convenience of the reader I have laid them out in a kind of table, to exhibit them together in one point of view. With regard to the porter it may be useful as curious to see and know the gradation of the *grists* and *heats* of the *liquors*, as they progressively advanced to the present time.

THE WORT OF THE FOURTH MASH, AND TABLE BEER.

The Wort of the Fourth Mash, so often alluded to in this Treatise, and the application of it so frequently assigned to making *sours* for the preparation of *finings*, which, it is well known, would consume but a very inconsiderable part of it, were they to be employed for no other purpose, in houses that brew from sixty to ninety times in the season, or oftener, and who do not brew *table beer*. I think it necessary here to advert to the manner that some gentlemen in the trade

trade have recommended to dispose of the superfluity of the wort of the fourth mash, which is, to use it instead of so much liquor in the brewing of the succeeding day. I have only to observe, that this has been the practice of the malt-distiller for many years, and with him it is unexceptionable; but when it is considered, that it is always a weak, and generally a liquor of an acid tendency, the impropriety, and even danger, of using it in brewing beer or ale, must be apparent, with respect to its hastening the decline of such beer. It will certainly suit a vinegar-maker, whose object is acidity; and may be used with impunity by the malt-distiller; but let the porter and ale brewer beware how he risks his future gyle in this way; and let those who make a practice of it account, in future, for their redundance of *stale beer*, and many other intruding inconveniences they were heretofore at a loss to account for.

The Pale and Amber Brewer may with less danger employ it in the way recommended, when brewing for *table beer*, an article never expected to keep for any considerable length of time. It may also be used with impunity in brewing for *twopenny*, another article prepared for present use. Still the *Porter Brewer* has no vent for the superfluous part of the worts of the fourth mash, except he could dispose of them as sours, or for six-shilling small beer. In order to avoid incurring the operation of the penal statutes, let us see, do they interfere here. By the 22d Geo. iii. s. 3. the brewer shall make his *table beer* of one entire gyle, and shall not, on any pretence, make it of the above quality and price* from any party gyle: and any such, made from any party gyle, by any brewer, or person who shall sell or tap out the same, publicly or privately, shall be charged by the Officers of Excise as strong beer, and they shall pay the duties accordingly." The intention of the Legislature is evidently to encourage the brewing of *entire-gyle table beer*, as a better

* Sixteen-shilling beer.

and more wholesome beverage than that formerly brewed, after the worts of the first and second mash had been extracted for strong beer. This should not, in my opinion, militate against the use of a better article than water, which, in this case, the wort of the fourth mash may be allowed to be, and intended to appreciate, not depreciate, the *table beer* to be drawn with it, which is still produced from an *entire gyle* of malt worts, and the whole produce of an *entire grist.*

TABLE BEER.

Mr. *Addington's Bill* enables the table beer brewer to keep up the quality of this necessary article, by fixing the duty at two shillings per barrel only, and deeming no beer strong beer that is not above the price of eighteen shillings a barrel, over and above the duty, which is well calculated to enable the brewer to supply the public with good and wholesome table beer, at twenty shillings per barrel; a matter of the highest importance to all ranks, as its consumption lays among every class of people. The annual consumption of which, is 4,316,676 barrels, in England and Wales; which should produce, at 2*s.* duty per barrel, 431,667*l.* 12*s.*; a sum that ought to be brought into the Exchequer annually, and stand at the foot of the annual amount of the produce of *table beer;* that is, the gross amount, before the expences of *management* and collecting expences are deducted, which it proportionally shares with the strong malt liquors of the *English brewery,* of which it is, in this respect, but a minor article; *these computations are estimated on warrantable data.* The preceding calculation is exclusive of a duty of 18*s.* 8*d.* per quarter on 719,446 quarters of malt, from which the table beer is brewed,

brewed, amounting to 665,932*l.* 11*s.* 4*d.* which, with the amount of the duty on the hops employed, is 710,898*l.* 3*s.* 4*d.* to be added to the duty on the beer, 431,667*l.* 12*s.* making in toto, 1,142,565*l.* 15*s.* 4*d.* A sum that the world will allow to be a tolerable good price for a bill of health, paid by the people of England to government, to secure them a good wholesome TABLE DRINK at their meals, besides paying the brewer a full price for the article itself; a price equal to what was paid for porter in the last *reign;* yet that security has not been obtained. Or more distinctly thus:

	l.	*s.*	*d.*
Duty on Table Beer — — —	431,667	12	0
Duty on the Malt used — — —	665,932	11	4
Duty on the Hops used — — —	44,765	12	0
Gross amount of the Duties on Table Beer, for 1804,	1,142,565	15	4
Amount of the Duty on Small Beer, of 6*s.* price per barrel — — — — —	26,096	0	0

No. 1. in the following table exhibits a grist of fifty quarters of all brown malt, with the mean of the heats of four mashes at one hundred and fifty-seven degrees. No. 2. twenty quarters of amber, and thirty of brown malt, with a mean of heats up to one hundred and seventy degrees. No. 3. ten of pale, fifteen of amber, and twenty-five quarters of brown malt, the mean of the heats one hundred and seventy-three degrees. And No. 4. fifteen of pale, twenty of amber, and but fifteen quarters of brown. It should be remarked, these are the grists and heats of as respectable houses as any in London of their day. That No. 3. and 4. are the cast of work in the same house, who was reputed to brew as good and sound an article as any

of his neighbours, though he usually took his first liquor at the common temperature of the atmosphere, which, in the usual way of speaking, is commonly called *cold water*; and brought his second liquor quite through, that is, did not turn it on the worts before it boiled; as noted in these numbers 3. and 4. Perhaps we never had a more experienced brewer than the composer of grist, Numbers 5. and 6. the whole circle of whose variations were within this compass; the mean of his heats always being at, or between one hundred and sixty to one hundred and sixty-five degrees; he did not use brown malt for many years; coloured high, and his beer wore as good a face as any *porter* or *stout* in England. The grists of the house now much exceed the quantities set down here, and its reputation unblemished. The brown malts have lately been so much better than formerly, they sometimes use one third of it in making up their grist for keeping beer and stout. Such has been, and such is, the usual practice of Porter brewing.

The grists, and heats of the best table beer brewers, make No. 7, 8, and 9. of the table; and the length they draw is commonly eleven and a quarter, to twelve or thirteen pounds specific gravity per barrel. A practice worthy of imitation with respect to the public, and much more to their credit than profit, with respect to themselves, as the price of malt now stands, and has for some time stood.

THE

The old *Heats of Liquors and Quality of Grists, in the Gradation they approximate towards the* present *Heat of Liquors and Quality of Grists, for Porter, Twopenny, &c.*

PORTER AND TWOPENNY.

Number of Mashes.	No. 1.	Quality of the Grists.	Heat of the Liquors.	No. 2.	Quality of the Grists.	Heat of the Liquors.	No. 3.	Quality of the Grists.	Heat of the Liquors.
		Qrs.	Deg. 150		Qrs.	Deg. 155		Qrs.	Deg. 55
1st.	——	—	165	——	—	175	——	—	212
2nd.	——	—	145	Amber Malt	20	160	Amber Malt	15	160
3rd.	——	—	170	Brown ditto	30	180	Brown ditto	25	173
4th.	Brown Malt	50	4)630	Mixed Grist	50	4)670	Mixed Grist	50	4)600
	Mean of the Heats		157½	Mean of the Heats		167½	Mean of the Heats		150

MORE AND MORE MODERN.

	No. 4.			No. 5.			No. 6.		
1st.	Pale Malt	15	58	Pale Malt	35	170	Pale Malt	20	180
2nd.	Amber ditto	20	212	Brown ditto	15	150	Amber ditto	30	150
3rd.	Brown ditto	15	158	——	—	190	——	—	190
4th.	Mixed Grist	50	188	Mixed Grist	50	130	Mixed Grist	50	140
			4)616	——	—	4)640	——	—	4)660
	Mean of the Heats		154	Mean of the Heats		160	Mean of the Heats		165

TABLE BEER WITH THE BEST PALE MALT.

	No. 7.			No. 8.			No. 9.		
1st.	——	—	170	——	—	166	——	—	164
2nd.	——	—	145	——	—	177	——	—	170
3rd.	——	—	165	——	—	154	——	—	152
4th.	All Pale Malt	—	130	All Pale Malt	—	145	All Pale Malt	—	141
			4)610	——	—	4)642	——	—	4)628
	Mean of the Heats		152½	Mean of the Heats		160½	Mean of the Heats		157

The table beer brewers, and others, might mistakenly imagine, that I did not hold them in sufficient estimation to give them a process, the majority of whom are equally as respectable as useful to the community, who are supplied by them with the most wholesome among malt liquors as a table drink, and sanative dilutent partook of by all ranks of people. I need not here further enumerate the advantage that pale malt has over amber, and particularly over brown malt, enough having been said on this part of the subject already. The *taste* of the customers, and their *eye* must be pleased; some requiring it quite *pale,* others *amber,* and some think it weak if it is not *brown;* circumstances that must ever influence the brewer more or less; for it is not enough that it is always sound and good, it must also be to their liking.

The Process of brewing TABLE BEER, *averaged that a Quarter of the best Malt and Six Pounds of the best Hops shall produce Six Barrels of* TABLE BEER.

		No. 1.		No. 2.		No. 3.		No. 4.	
Number of Mashes.		Heat of the Liquor.	Barrels of Liquor.	Heat of the Liquor.	Barrels of Liquor.	Heat of the Liquor.	Barrels of Liquor.	Heat of the Liquor.	Barrels of Liquor.
		Deg.		Deg.		Deg.		Deg.	
1st.	—	164	2	166	2	170	2	150	1½
2nd.	—	171	1	177	1½	145	1½	170	2½
3rd.	—	152	3	154	1½	165	2	145	3
4th.	—	141	2	145	3	130	3	165	2
	—	4)628	8	4)642	8	4)610	8½	4)630	9
Mean	of the Heats	157	—	160½	—	152½	—	157½	

Here one quarter of malt, and six pounds of hops are presumed to produce six barrels of good *table beer* of eleven, eleven and an half, twelve or thirteen pounds specific gravity per barrel. Of the eight barrels of liquor used per quarter one is presumed to be absorbed by the goods, and one barrel evaporated in the coolers. *Close coppers* admitting of very little or no evaporation. *The first mash* should not take up more than three quarters of an hour in summer, and but an hour in winter. The first tap may stand three quarters of an hour in summer, and an hour in winter. The second and third *mashes* half an hour, the taps may stand an hour in summer, and an hour and an half in winter. The fourth *mash* requires good working, and the tap may stand two hours in summer, and as long as convenient in winter. *Boil* the two first worts with the whole of the hops for an hour and an half, or two hours in a *close copper*, and the two last worts with the same hops, two or three hours. Be careful in summer or warm weather to *pitch* at the lowest heats you can bring the worts too, by standing all night in the cooler, and letting them down into the gyle tun or squares, half an hour before sun-rise; if they should not sink to fifty-five, or at most sixty degrees by the thermometer before that time; for if they get a turn in the cooler, you will not get the yeast well out of the beer, which will never be so perfectly fine, as otherwise, and will sooner become stale. A quart of live yeast per quarter will be full sufficient in summer; you may use more in winter in proportion as your worts get cooled below sixty degrees of temperature.

Cleanse or tun your table beer, soon as it has a good close yeasty head, into the barrels on the stillions, and *fill up* every two or three hours for the first twelve, *filling up* the seldomer as the heat and fermentation declines; always taking care that the casks are full enough to throw off the yeast and lees at the bung hole. A low attenuation will not do here; the low gravity of the worts will not bear it. Your barrels should be bunged down close, and as tight as a bottle, or

the beer will not be brisk and mantling when tapped, nor will it keep so if much air is admitted while running; if this is attended to, and the casks air-tight, the briskness and mantling may be preserved to the last. Those who like it to run still into the jug, may, by a contrary management, admit the external air, and suffer the included air to go off at the vent. Table beer *flattened* in this way will soon be vapid; the loss of the fixed air is the loss of strength. For bottling, *See Bottling for Exportation*. *Briskness may be regenerated* by adding, as it is sent out, half a pint of strong wort to each barrel that appears *flat*, and from that to a quart, in proportion as it may be found wanting, the operation of which will be very apparent, by the time it is delivered to the consumer. In fact, there is no other *addition* wanted to complete our malt liquors, than sweets of any kind, as molasses, sugar, honey, &c. And when the *legislature* deigns to admit that, all our malt liquors will be proportionably better. Their being at present prohibited, is an ill-founded objection; and may be answered by requesting they would look back to the reign of *Queen Elizabeth*, where they will find, that the use of *hops* were prohibited in malt liquors, upon just as good grounds as all other bitters are disallowed now by recent Acts of the *Legislature*.

Greyness in beer, and the method of *preventing* and *curing* it, is a subject of so much importance that I have not room at present to do justice to it; therefore shall reserve what I have discovered on that head, to be communicated by personal interview. With regard to a particular description of the *thermometer* and *hydrometer*, the makers of these instruments give printed directions with them. In many parts of the process of brewing, the hydrometer will be found to be such a guide as to merit the most earnest attention. And, indeed, though the operator should proceed in the most rational method hitherto known or practised, and regulate his heats by the directions of a thermometer, yet he cannot have the satisfaction of knowing what quantity of valuable or fermentable matter he has obtained, but by means

means of this other most useful instrument. This leads us to speak, more particularly than hitherto, of the various kinds of hydrometers made. Some of them by their makers claiming the preference over all others, which, of course, they condemn as totally insufficient; whereas the fact is, that all, or any of them, provided they are well finished and perfect in their kind, will be found fully competent to the end. The principle of their operation not admitting of any considerable variation in their form; and the difference among them all consisting principally in the scale, or in the sum of their indications. *Quin's* are the most accurate, strong, and well-finished, and, having the fewest weights, the most simple and expeditious in the application. The extreme usefulness of the thermometer is now generally known in the public brewery, who cannot, like the private brewer, if ten bushels of malt will not obtain a hogshead of very stout beer, use twelve or fourteen; or, if the beer does not become fine at the end of ten or twelve months, suffer it to stand eighteen or twenty-four months; and the age of the beer, which is, in fact, nothing more than the result of ignorance, is mentioned at table as one of its strongest recommendations.

Mr. J. Baverstock, an experienced brewer, concerned in the brewing *Windsor ale,* in a pamphlet he published in 1785, entitled *Hydrometrical Observations,* inculcating the application of the hydrometer in the *public brewery;* in an appendix to it, makes the following observations on *Mr. John Richardson's* philosophical principles of the science of brewing, statical estimates, &c. particularly that part relative to the *saccharometer,* he introduces, and the mode he recommends of obtaining standard gravities. I beg leave to give it in Mr. B's. own words, as I have done what I have extracted from Mr. R. and without comment, leave the decision to the reader.

" It was very much our author's wish to avoid all occasion of noticing a late publication, on the preceding subject; but as that work

 may,

may, by some, be thought to have precluded the usefulness of the present treatise,* it becomes incumbent on us to make some remarks on the differences which will appear in our mode of forming average standard gravities (which is the foundation of the principal advantages to be derived from the instrument,) and in that method, which is recommended in the Statical Estimates. It may be observed, from all that we have hitherto said, that in *principle* we agree with that author most entirely; in *practice* we differ from him very materially. It is no more than justice to Mr. R. to say, that his last and former publications shew him to be possessed of knowledge in the brewery more than any other person who hitherto appears to have written on the subject. His instrument likewise may, with some alteration, be rendered as proper for the brewer to adopt, as any other of the kind.

"But, with regard to that part of the saccharometer which is the only novelty of it, as an hydrostatical contrivance, the regulator, impartiality demands of us to say, that this may be dispensed with, even to the improvement of the instrument; as well with regard to accuracy, as to the convenience and dispatch of its application.

" Having gone so far as to assert this, it will be required of us to explain our reasons for entertaining this opinion; and, also, to propose some other means for discovering the differences in water; which is a circumstance allowedly essential. This then may, in our judgment, be done effectually, by making the lower stem of the saccharometer fixed as the upper, and by having the whole instrument so adjusted as to sink to O in rain-water. Every other water will then occasion the instrument to rise, in proportion as such water is heavier than rain; whereby the differences in water might be found most precisely. And thus the regulator, which is a great incumbrance, would be rendered unnecessary. To this it may be added, that, notwithstanding

* Baverstock, on the Hydrometer.

standing all the care and skill of the maker (which are not to be disputed,) it appears to be scarcely possible, where the instrument is daily or much used, to prevent the regulator from being moved from its station, by very slight and unavoidable incidents. For, the friction of frequent use will be found to wear the piston and tube, so much as to occasion the movement we have just mentioned. And, when this is the case, it can no longer be expected that they should be perfectly air-tight, as they are intended, and, to be useful, most assuredly ought to be. If it should be asked, how we can judge of the practicability, or otherwise, of constructing any part of the instrument, we must answer, that our observation, in this case, is drawn from what we have experienced in a saccharometer; which we doubt not, because we were so assured by the maker, was one of the best that had been constructed.

" But a still more exceptionable part of Mr. R's. system is his method of forming average and standard gravities. All the philosophical nicety and attention which he has bestowed on the regulator, even if they were of any use, are much more than counterbalanced by his manner of determining this, which is the grand essential point. It is beyond measure surprising, that a person of Mr. R's knowledge should have been so much mistaken, as to neglect a plain and easy road, and to be found wandering in the paths of doubt and uncertainty. What occasion can there be for the brewer, in order to learn the average gravity of the day, or to form the standard density of his gyle, to perplex himself with the gravity of his worts in the under-back, or copper? or why trust to what is supposititious, when he may, with less than a tenth part of the same time and trouble, obtain a certainty? Why, instead of making a great variety of trials on the worts in the copper, and depending on calculations as to the quantity to be evaporated, and as to the expected final density of his worts; why not wait for their *actual* density when in the coolers? at which time, also,

 and

and not till then, the quantities of each wort may be precisely ascertained; without which, all decisions as to the average gravity must be vague, and in no case to be relied on. It may be said that the whole business is rendered certain, by means of tables and calculations, formed on purpose to ascertain the final quantity and quality. We forbear to say much on this head; because Mr. R. acknowledges that these calculations do not always correspond with the event. Nor is it probable that they would serve as directions in all other offices or situations, even if they were less fallible in that brewhouse, where they were first formed.

" In forming average standard gravities, either with two or with three worts, the foundation of Mr. R's. system is to reduce the quantity of the last wort, by evaporation, so much as to leave the quantity, as well as quality, just such as will serve the intention. Thus, in the case of a gyle compounded of two worts for strong beer, fixing the average at 29,8 pounds per barrel, and finding the specific gravity of the first wort to be 34,25 when cool; the second wort, on a supposition that their quantities were to be finally equal, must be of the density 25,35, to produce such average. Now, this second wort, when raw, proving to be no more dense than as 17,6 pounds per barrel, (but being improved by the hops and the first wort retained in them to 20 pounds per barrel) must be evaporated, by boiling in the copper such a length of time as serves to bring it to the density required, or 25,35. This is to be effected by evaporating 7,4 barrels out of 29,4 barrels.

" Of these 7,4 barrels, 5,4 barrels are to waste in the copper; the remaining two barrels are supposed to evaporate in the passage of this wort from the copper to the cooler, including its continuance therein.

" Again,

" Again, in the case of three worts intended to form one gyle, fixing the average at 25,55, and finding the amount of two parts (the two first worts) to be as above, 59,6; the third wort, on a like supposition that the final quantities are to be equal, must be of the density 17,05, or say, 17, to produce such average.

" This last wort, therefore, which, while raw, goes into the copper at a gravity of 9,25 pounds, and by the addition of hops and of second wort left in them is increased to 11,5 pounds previous to boiling, must be evaporated by such a continuance of boiling, as suffices to bring it to its required density 17. In all these cases, also, the quantity to be turned out of the copper is to be judged, not by gauging, for that, Mr. R. says, is here impracticable, but the whole amount of fermentable matter contained in the wort in the copper, being reduced to one sum, or aggregate, is supposed to be fixed; or, in other words, as the quantity lessens by evaporation, the quality of the remainder is improved. Thus, the present wort consists of (including what is added to it by the hops) 30,26 barrels, at 11,5 pounds; the aggregate, or whole fermentable matter whereof is, therefore, 358,99. If, after it has boiled two or three hours, we take an observation, and should find the specific gravity to be 14,5 pounds, dividing this in 358,99, the quotient says, that 24,75 barrels only are now remaining out of the 30,26 barrels which went into the copper. And the brewer is to form his final quantity as well as quality, by means of a frequency of such examinations of his last wort, while in the copper. The quantity of raw wort, which went into the copper, was 30,26, or say 30 barrels and a quarter. To occasion a sufficient increase in the density of this wort, so as to form the average required, no less than one-third part of that whole quantity is to be evaporated.

" Let the practical brewer consider well this circumstance, and, passing over the doubt and uncertainty of ever hereby obtaining the precise

precise specific gravity required, let him observe somewhat on the great waste of time, fuel, and of so much of the pleasing qualities of the hops, as may yet remain in them, caused by this method.

" Whenever it happens that the worts, all or any one of them, are inferior in gravity to the example, (which we have taken from the Statical Estimates) the evaporation of the last wort becomes, necessarily, still greater. And what the produce of the malt may be, no one can foresee or venture to judge. For our own part, we should be unwilling to speak within five per cent. of the expected value of the malt used in the operation of any one day, previously to having ascertained the yield, when in the coolers, by our instrument.

" Putting the case, therefore, that three worts are intended to form one equal liquor, by being fermented together, and that on examining the two first worts, already boiled off, and laying in the coolers, and taking also the third wort, in its raw state, in order to attain the means of producing the average gravity required, the quantities and qualities should respectively be found to be as follows : *viz.*

" First wort	—	—	21,5	at	33,25
" Second —	—	—	22,	—	24,5
" Third (raw)	—	—	30,26	—	8,25

" Pursuing the method of calculation laid down in the Statical Estimates, we find that the third wort, which, in its raw state, was no more than 8,25 pounds, must (in order to render the final quality of the aggregate 25,55) be improved by evaporation to 16,9 pounds of fermentable matter per barrel; which will require a decrease in the quantity of 13,86 barrels out of 30,26, or 499 gallons out of 1089 gallons. Of which 499 gallons, 434 gallons are to evaporate while the wort is boiling in the copper; and the remaining 65 gallons are

are expected to fly off in the passage of the wort from the copper to the cooler, including its continuance therein.

" We trust it cannot be said, that we have here made an unfair statement, by putting a case, as to the yield or value of the malt, not likely to happen. Neither will the brewer have it in his power to prevent the necessity of such excessive evaporation, by judging previously of the quality of his malt, or by forbearing to apply the usual quantity of water in the third extract, on finding the specific gravities of the first and second worts to be inferior to his expectations. For, the third wort, according to the necessary procedure, is wholly run off from the malt, and lodged in the copper for boiling, previous to the examination of the two first worts in the coolers. So that no opportunity is afforded of lessening the quantity, with a view to improve the quality of the extract, otherwise than by evaporation, so far as that goes.

" The inferiority of the malt in the present example, compared with the actual brewing in the Statical Estimates, is not seven per cent. And as to the probability of the brewer being mistaken in the previous judgment which he may form of his malt, to such an amount as six or seven per cent. we shall not refer to what we have ourselves already said on that subject; but shall quote the remark of Mr. R's. Statical Estimates, p. 73, where, speaking of two specimens of the produce of *the same kind of barley*, under the management of two different maltsters, he says, ' In the former there is a superiority ' over the latter of nine per cent.; a considerable difference, to an ' amount which, in most commercial concerns, is deemed a fair ' profit; and yet these two parcels of malt would have passed, among ' common consumers, with this simple observation, that this *sample* ' *is freer than that;* the difference in sale would not, perhaps, have ' exceeded a shilling per quarter, and the brewer would have thrown ' them indiscriminately into his mash tun, drawing his usual length

' from

'from each, to the positive loss of nine per cent. either in the quality 'of his liquor from the latter parcel, or in the obtainable profits of 'his trade from the former, which ever might happen to tally with 'the general quality of the malt he used.'

" We agree most cordially with Mr. R. in every syllable of the above remark; as we do with him, we can with strict sincerity say, in every part of his book, excepting all that relates to the means of obtaining average and standard gravities; which, we are sorry therefore to observe, is the corner-stone of the whole. We forbear to comment at large on the method of forming the length, by frequently taking the specific gravity of the last wort, in the copper. We believe that very few brewers will trust entirely to such observations. In this point, however much they may be assisted by the tables and calculations, formed purposely for their direction herein. We imagine the operator will take a single gauge of his worts in the coolers, which cannot engage him more than a minute; just to note how nearly *this actual* quantity *(which is really final and certain,)* corresponds with those calculations; the observance of which has necessarily required his previous attendance at the copper-side during several hours.

" And what if he should then find (which is a case not at all unlikely to happen) that the actual event, both as to quantity and to quality, should be widely different from his expectations, as grounded on the tables and calculations?

" Would he in such a case, we say, govern himself with regard to his length, and the standard average gravity of his gyle, by this actually final event; or would he finish the operation of the day, not regarding what his quality really and truly may be, but what it *ought* to have been according to the calculations?

" To

" To conclude. In all that has been said on the subject of Mr. R's. saccharometer, and on the method of applying it, we trust that we cannot be suspected of having any other motives, than what arise from an earnest desire to render the use of an hydrostatical apparatus less difficult, in order to its becoming general in the brewery.

" With regard to the instrument, we have no maker whom we wish to recommend, or to prefer on any other consideration, than as the instruments themselves may be well finished, and perfect of their kind. In this view Mr. Troughton stands as forward as any one we know, or have heard of. And, if the regulator *must not be given up*, let the practical brewer inform himself, by a few observations, what are the differences occasioned in his worts, by the piston of the regulator being shut wholly into the tube. Suppose the difference between the fixing the regulator at the point required to sink the instrument to O, and between the shutting it wholly in, should be 0,6, or six-tenths of a pound. If a wort should contain 24,8 pounds of fermentable matter as exhibited by the saccharometer when the piston of the regulator is quite closed into the tube—the brewer has only to call the specific gravity of such a wort 25,4 pounds, in order to be fully as accurate as he would be by setting the regulator.

" As to the method of forming average or standard gravities, it must evidently be a matter of indifference what are the means made use of, provided the end is obtained. Our own general observations during the process of brewing, and indeed an experiment which we made purposely with a view to judge of the propriety and practicability of excessive evaporations, are not at all in favour of that method. We chuse, however, to leave the decision of this matter to the practice and examinations of other brewers, who may, perhaps, perform the operation with more success; observing only, that although it should be found to be practicable, it must unavoidably be tedious and inconvenient. And even if the brewer should have so

much perseverance as to disregard all other considerations, one still remains which is of the utmost importance in the present concern; namely, the doubt and hazard of ever, hereby, obtaining the exact average, or standard gravity required.

" Those brewers, therefore, who may be induced to use an hydrostatical instrument constantly, will, of course, adopt that method which they may severally find to be to themselves most easy, most convenient, and, in the final event, as to quantity as well as quality, most certain."

With respect to the minutia occurring every day in a brew-house, that brewer who does not notice these matters may commit, or admit, great errors, and he whose notice they escape must be a very inaccurate observer. *In storing beer,* the recent gyles should be started together in vats or store casks by themselves; and never mixed with gyles of any standing; except a store vat of beer, from the badness of the cask, or any other accident that admits the external, and transmits the fixed air, falls flat, or becomes stale, then it may be expedient to restore it by the addition of a fresh gyle of beer, which will soon make it fit for present use, by exciting a languid fermentation, that will generate *briskness,* and partially cover *staleness.* Nothing but a charge or impregnation of hydrogen gas, or inflammable air, will recover *sour beer,* which at the same time adds spirituosity or strength, with pungency. For alkalies, alkaline earths, or calcareous substances, as oyster-shells or chalk, in powder, which have been imprudently resorted to for this purpose, destroy the quality of the beer, and render it vapid and unwholesome. *Biting of the yeast* happens in different ways: 1. When from a sudden change of temperature in the atmosphere, from cool to warm, when the worts are nearly ready for *pitching,* and they consequently get a *turn,* if they escape *foxing* in the *tun,* yet the yeast never works wholly out of the beer. 2. When the beer in the barrels on the stillions is neglected to be filled

up,

up, the yeast and lees cannot be worked out, but falls back, and is irrecoverably incorporated with the *drink*. 3. From the practice of *drawings*, that is, the beer or ale which separates from the yeast on long standing, not the frothy part of the yeast that falls into beer, the latter improving the drink, the former giving an incurable taste of the yeast, called *biting of the yeast*. 4. About the close of the last and the beginning of the present century, when the distillers did not work on account of the scarcity of grain, the great quantity of yeast which they usually consumed was thrown upon the hands of the brewery, and manufactories were set up for drying the superfluous yeast for exportation to our West-India colonies, to assist the fermentation of the materials employed in the production of *rum*. The beer that run from the pressings of the yeast on this occasion, was returned to the brewer in exchange for the yeast. This beer, highly saturated with the yeast, contaminated the beer it was imprudently mixed with.

Breaking in Beer. Beer is returned for various reasons, the usual causes are, greyness, staleness, being foul, flat, sour, &c. If this beer is started altogether into a clean tight vat, which it nearly fills, it will in general come round in a little time to be saleable good beer. When it does not shew a disposition to mend in a fortnight, three weeks, or a month at most, add new-gyle beer from the stillions, in the proportion of one of the new to three parts of the old beer, and this will bring it round and fit for present use if the cask or vat is air-tight; and it will often prove as pleasant beer as any in the house, and equally as good and wholesome. There is nothing requires more attention than the complete *tightness of the store vats* for keeping beer; if this is not carefully attended to, the beer, which should improve in mellowness and strength by age, becomes stale and flat. The *store house*, or store cellar, should be in a still place, out of the way of heavy carriages, influxes of air, or any thing that could disturb the beer, and kept of an equal temperature.

End of Book I.

ABSTRACT of an Estimate of employing 3000l. chiefly in the making of Wine Vinegars, *and but partially in the Preparation of* Wines *and* Brandy, *&c. The Vinegars will be much about the Standard, and equally as well flavoured, spirituous, and strong, of the German, French, and Italian Vinegars usually imported. The Wines good representatives of Malaga, Red Port, Sherry, and Hock or Rhenish Wine, and sometimes turn out a good Succedaneum for Madeira. The* Brandy, *&c. indistinguishable from foreign. The whole of them so good in quality, and cheap in price, as to meet with unrivalled sale. It is well understood, that the Vinegar Business is the most lucrative of any of the Exciseable Branches of Trade; yet, on taking a near View of the comparative Profits resulting from the advantageous Method of making Vinegar, at present adopted,* (1782) *it will appear, that* 3000*l. laid out agreeably to my plan, will be equally as productive as* 16,000*l. expended in the usual mode.*

VINEGAR ESTIMATE.

Utensils 500l. viz.

	£.	s.	d.
A three hundred gallon Copper	30	0	0
Two Stoves	20	0	0
Bricklayer	15	0	0
Smith	10	0	0
Six Rape Casks	60	0	0
Six Store ditto	48	0	0
Thirty-two Fermenting Puncheons	16	0	0
Fifty-two Souring Hogsheads	26	0	0
Fifty-two Attempering ditto	26	0	0
One Settling Back	15	0	0
One Jack ditto	15	0	0
Two Mixing ditto	20	0	0
Six Pumps	20	0	0
A Horse Mill	30	0	0
A Cart and two Horses	30	0	0
A Lever Press, Hair Cloths, Canvas Bags, &c.	10	0	0
Carpenter	30	0	0
Cooper	20	0	0
Plumber	10	0	0
Fitting up	49	0	0
Utensils C. O.	500	0	0

N. B. When Wine and Spirits are added, the Utensils will amount to 1000*l*.

[illegible]	[illegible]	6	Returns.
[illegible]	11	2	Expenditures.
[illegible]	18	4	Profits.
54	6	0	Drawbacks, &c.
457	12	4	[Bal]ance.

	£	s.	d.	£.	s.	d.
Utensils B. O.				500	0	0
56 Cwt. at 15s. per cwt.	42	2	0			
3½ Cwt. at 45 ditto	3	2	6			
Flavouring and fermenting Ingredients & Chemical Corrector	3	5	0			
Materials				58	7	6
Wages per week	4	10	0			
Fuel	4	12	0			
Rent, Taxes, and Contingencies	6	0	0			
Sundries				15	2	0
Average Excise on 2340 gallons of White Wine Vinegar at 5d. per gallon				48	15	0
Total weekly expenditures				122	4	6
Multiplied by 18 weeks						18
Gives the circulating Capital				2,200	1	0
Surplus to purchase Rape, and buy Casks to contain the Vinegar and sell it in				299	19	6
Capital at commencing business				3000	0	0

AVERAGE ACCOUNT,

Taken for Six Weeks, to compute by.

[Aver]*age Account to Sundry Accounts.* *Dr.*

	£	s.	d.	£.	s.	d.
[illegible] 3 Cwt. at 15s. [per c]wt.	123	15	0			
[illegible] Cwt. at 15s. do.	82	10	0			
[illegible] Cwt. at 15s. do.	45	0	0			
[illegible] Cwt. at 15s. do.	47	5	0			
[Fer]menting and fla[vour]ing Ingredients, [and] Chemical Cor[recto]r, at 8*l*. 5*s*. ditto	49	10	0			
Materials				348	0	0
[illegible] at 4*l*. 10*s*.	27	0	0			
[illegible] 4*l*. 10*s*.	27	12	0			
[Rent], Taxes, and Con[tin]gencies, at 6*l*.	36	0	0			
Sundries				90	12	0
[Exc]ise on 14,014 gallons of different [Wh]ite Vinegars, at 5d. per gallon				291	19	2
5*l*. per cent. draw[b]ack for Repairs and [an]nual Contingencies	27	3	0			
5*l*. per cent. com[mi]ssion for Manu[f]acturing, &c.	27	3	0			
[on] 54*l*. 18*s*. profit				54	6	0
Balance gained				487	12	4
Amount				1,272	9	6

Per Contra. *Cr.*

	£	s.	d.
By 7425 gallons White Wine Vinegar at 1s. 6d. per gallon	556	17	6
By 4456 gallons choice White Wine Vinegar, at 2s.	445	12	0
By 2160 gallons prime White Wine Vinegar, at 2s. 6d.	270	0	0
Returns (Errors excepted)	1,272	9	6

N. B. 487l. 12s. 4d. gained in six weeks, is 81l. 5s. 4d. per week, which is, per ann. 4225l. 17s. 4d.
From 4225 17 4, the annual profit,
Take 1408 12 5, the third of ditto,

2817 4 11, remains two-thirds towards paying off the Mortgage, which can be paid off with Interest, in about one year and a fortnight, or in double that time with one-third of the profits.

WINE ESTIMATE.—*Utensils about 300l.*

MALAGA WINE *to sundry Accts,* *Dr.*

	£	s.	d.	£.	s.	d.
To 7425 gallons of the Vinous Fluid, previously fermented for Brown Wine Vinegar, at 7¾d. per gallon	239	15	3¾			
To 3712lb. clayed Sugar, at 8d.	123	14	8			
*To 7425 oz. at 1s. 6d. per lb.	135	4	9			
Materials				523	14	3¾
Excise on 7425 gallons of Wine, at 8d. per gallon				247	10	0
Ditto, on 116 additional gallons, at 8d. per gallon				3	17	4
Wages, fuel, and additional expences				10	0	0
To Drawback and Commission on 346l. 1s. 4¼d.				34	12	0
To Balance gained				311	9	4¼
Amount				1131	3	0

* Should be 14,850 oz. 69l. 12s. only,
Then £311 9 4¼
And 59 5 4

Is 370 14 0¼ the true Balance.

Per Contra. *Cr.*

	£.	s.	d.
By 7541 gallons of Malaga Wine, at 3s. per gallon	1131	3	0
Returns	1131	3	0

By correcting a mistake on the other side, the Balance is 370l. 10s. 8¼d.

£1131	3	0	Returns.
719	4	3¼	Expenditures.
411	18	8¼	Profits.
41	4	0	Drawback & Commission.
370	14	8¼	

RED PORT *to Sundry Accounts,* *Dr.*

	£	s.	d.	£.	s.	d.
To 7425 gallons Vinous Fluid, &c. &c. at 7¾d. per gallon	239	15	3¾			
To 464 gallons of our Brandy, at 7s.	162	8	0			
To 464 oz. at 1s. 6d.	34	16	0			
2 Cwt. at 34s.	3	3	0			
1 Cwt.	3	12	0			
Additional flavouring Ingredients	15	0	0			
Materials				458	19	3¾
Excise on 7425 gallons Red Port, at 8d. per gallon				247	10	0
Wages, fuel, and additional expences				12	0	0
To Drawback and Commission on £881.				88	3	0
To Balance gained				793	7	8¼
Amount				1600	0	0

Per Contra. *Dr.*

	£	s.	d.
By 8000 gallons Red Port, at 4s.	1600	0	0
Returns	1600	0	0

£1600	0	0	Returns.
718	9	3¼	Expenditures.
881	10	8¼	Profits.
88	3	0	Drawback, &c.
793	7	8¼	Balance.

SHERRY WINE *to sundry Accounts,* *Dr.*

	£	s.	d.	£.	s.	d.
To 8912 gallons Vinous Fluid, previously fermenting for choice Wine Vinegar, at 8d. per gallon	279	1	4			
To 200 gallons of Brandy at 7s. per gallon	70	0	0			
Additional flavouring Ingredients	15	0	0			
To 5 Cwt. at 15s. per week	15	0	0			
Materials				397	1	4
Excise on 9312 gallons, at 8d. per gal.				310	8	0
Wages, fuel, and additional expences				14	0	0
To Drawback on 943l. 2s. 8d.				94	6	0
Expenditures				815	15	4
Balance				848	16	8
Amount				1664	12	0

N. B. The Brown, or Common Vinegars, are from 10d. to 1s. 6d. per gallon. The White Wine Vinegars, from 1s. 5d. to 2s. 6d. per ditto. The Calculations comprehend the average prices of all estimated here.

Per Contra. *Cr.*

By Vinous Fluid, 8912
Additional ditto,... 400
Brandy, ... 200

	£	s.	d.
Made into ....9512 gallons of Sherry, at 3s. 6d. per gallon	1664	12	0
Returns (Errors excepted.)	1664	12	0

£1664	12	0	Returns.
721	9	4	Expenditures.
943	2	8	Profits.
94	6	0	Commission & Drawback
848	16	8	Balance.

WINE ESTIMATE CONTINUED.

HOCK *or* RHENISH *Wine.* *Dr.*

	£	s.	d.	£.	s.	d.
To 8640 gallons Vinous Fluid preparing for prime Vinegar, at 8½d. per gallon	305	17	4			
40 Cwt. at 15s. per Cwt.	30	0	0			
400 gallons of Brandy, at 7s. per gallon	140	0	0			
1 Cwt. at	12	0	0			
To flavouring Ingredients	24	0	0			
Materials				511	17	4
Excise on 9440 gallons of wine, at 8d. per gallon				314	13	4
Wages, fuel, and additional expences				12	0	3
To Drawback and Commission, &c. on 1186l. 9s.				118	13	
To Balance gained				1067	16	
Amount				2025	0	0

Per Contra. *Cr*

By 8640 gallons Wine fluid,
400 gallons Brandy,
800 gallons Wine fluid,

	£	s.	d.
Made into 9840 gallons of Hock, at 4s. 6d. per gal.	2025	0	0
Returns	2025	0	0

£2025	0	0	Returns.
838	10	8	Expenditures.
1168	9	4	Profits.
118	13	0	Drawback & Commission.
1067	16	6	Balance.

MADEIRA *to sundry Accounts,* *Dr.*

	£.	s.	d.	£.	s.	d.
To 8640 galls. of Vinous Fluid, at 8½d. per gal.	305	17	4			
540 gallons of Brandy, at 7s. per gallon	189	0	0			
40 Cwt. at 15s.	30	0	0			
156 lb. at 1s. 6d.	11	14	0			
Flavouring Ingredients	20	0	0			
Materials				556	11	4
Excise on 9440 gallons of Wine, at 8d. per gallon				314	13	4
Additional Expences, &c.				15	0	0
To Drawback and Commission on 1708l. 15s. 4d.				170	17	6
Balance gained				1537	17	10
Amount				2595	0	0

Per Contra. *Cr.*

By 8640 gallons Wine,
540 gallons Brandy,
800 gallons Wine,

	£.	s.	d.
Made into 9980 gallons of Madeira, at 5s. per gal.	2595	0	0
Returns	2595	0	0

£2595	0	0	Returns.
886	4	8	Expenditures.
1708	15	4	Profits.
170	17	6	Drawback & Commission.
1537	17	10	Balance

BRANDY ESTIMATE.—*Utensils about 200l.*

Brandy to sundry Accounts, *Dr.*

	£	s.	d.	£.	s.	d.
To 8640 gallons Vinous Fluid, preparing for prime Vinegar, at 8½d. per gallon	305	17	4			
To flavoring Ingredients	24	0	0			
To 84lb. clayed Sugar, at 9d. per lb.	3	0	0			
To 45lb. at 2s. 3d.	5	0	0			
Materials				337	17	4
Excise on 1680 gallons Brandy, at 4s. 4d.				364	0	0
Wages, Fuel, and additional Expences				12	0	0
Expenditures				713	17	4
To Drawback and Commission on 344l. 10s. 8d.				34	5	0
Balance gained per month on Brandy				310	5	8
Amount				1058	8	0

Ditto, ditto, on Hollands, £361 0 0
Ditto, ditto, on Rum, ... 177 6 8
Ditto, ditto, on Arrack, ... 227 1 0

Per Contra. *Cr.*

	£	s.	d.
By 2016 gallons prime Brandy, equal to foreign, at 10s. 6d. per gallon... Or, by 1680 gallons, hydrometer proof, at 12s. 3d. per gallon	1058	8	8
Returns (Errors excepted)	1058	8	0

£1058	8	0	Returns.
713	17	4	Expenditures.
344	10	8	Profits.
34	5	0	Drawback & Commission.
310	5	8	Balance.

N. B. £310 5 8 gained in four Weeks, is £77 11 8 per Week; and £77 11 8 per Week, is £4033 13 8 per Annum,
Which is 192 3 8 less than the annual gain by Vinegar.

£ 4225 17 4 as the Capital will be doubled by the third year, from the commencement, so will the Profits.

, The gain on the preparation of Wines, although estimated on Work done, is so very considerable as to exceed all probability. Therefore, it need only be noted, that inviting as they really are, as the money lays dead in them for a year, they can only be engaged in with an increased Capital. For further Particulars see the Abstract of the above Estimate.

TABLE, No. III. BREWING FOR PORTER. FORM OF RULING THE BREWERS' BOOK.

																					Daily Attenuation, with increase of Heat, and decrease of Gravity. Pounds attenuated.										
Date.	Quarters of Malt.	Specific Gravity, per Quarter.	Pounds of Hops.	Gravity added to the Worts by the Hops.	Number of Mashings.	Heat of the Liquor.	Barrels of Liquor.	Time of Mashing.	Standing of the Tap.	Heat of the Tap.	Barrels of Wort in the Under Back.	Gravity per Barrel.	Gravity per Quarter.	Fermentable Matter extracted.	Time of boiling.	Wort in the Coolers.	Gravity when pitched.	Heat at pitching.	Quantity of Yeast.	Heat and decrease of Gravity the First Day.	Second Day.	Third Day.	Fourth Day.	Fifth Day.	Sixth Day.	Seventh Day.	Cleansed.	Gravity of the Beer.	Length, or Barrels started.	Number of Pounds attenuated.	REMARKS.
1795.																															
																															For the application of this Table, see the Ale Brewers' Tables, No. IV. II. I. and the Distillers' Tables, Book the Second.
Febry.																															

TABLE, No. IV. BREWING FOR ALE.

4th April, 1803, the Temperature of the Air Fifty-eight Degrees: Brewed Fifty-five Quarters of Malt and Two Hundred and Seventy-four Pounds of Hops. The Produce in Ale, One Hundred and Thirty-seven Barrels.

																		Attenuation in the Squares, or Gyle Tun, with increasing Heat and decreasing Gravity.						
Specific Gravity, per Quarter.	Quarters of Malt.	Pounds of Hops.	Number of Mashings.	Heat of Liquor.	Barrels of Liquor.	Time of Mashing.	Standing of the Tap.	Heat of the Tap.	Barrels of Raw Wort.	Gravity per Barrel.	Fermentable Matter extracted.	Time of boiling.	Barrels of boiled Worts when pitched.	Gravity in the Coolers.	Heat at pitching.	Quantity of Yeast, in Gallons.	Attenuation, or decreasing Gravity, the First Day.	Second Day.	Third Day.	Fourth Day.	Fifth Day.	Cleansing the Sixth Day.	Length, or Number of Barrels of Ale started, or stowed away.	Dropped Fine.
				Degrees.		H. M.	H. M.	Degrees.		Pounds	Pounds.	H. M.		Pounds	Degrees.		Heat 68 Degrees.	Heat 71 Deg.	Heat 76 Deg.	Heat 81 Deg.	Heat 82 Deg.	Heat 82 Deg.		
88	55	274	1st.	184	100	1 30	1 45	145	50	42	2100	2 15	} 90											
			2nd.	198	64	1 0	1 0	155	64	26	1683	1 45												
...			3rd.	176	66	0 30	1 0	140	64	12	768	1 0	47				Pounds	Pounds	Pounds	Pounds	Pounds	Pounds		
				558	230	...	...	3 | 440	178	...	4551	...	137	33 2	66	8	29	27	24	16	11	8 5	137	the Length drawn.
		Barrels	of raw	Worts ...	178	...	...	146	Mean	Heat	of the Tap,	or Goods.												
				...	52	Barrels of	Liquor ab	sorbed an	d evap	orated.														
	Brough	t down	4th.	120	50	0 30	0 30	130	50	6	300	Employed	these fifty	Barrels	of blue	Worts	as Liq	uor ne	xt Day	in mash	ing.			
				4 | 678	...	...	...	...	...	...	55 | 4851 | 88	11--55ths	Gravity	per	Quarter.									
				164	the me	an Heat	of the	Liquors.																
									178															
									137															
									41	Barrels	of the aqueous	part of	the Worts	evapora	ted.									
88	55	274	4		280	3 30	4 15		178		4851	5 ·30	137	33 2	66	8	29	27	24	16	11	8 5	137	19 Apr.

REMARKS.

Barrels of Liquor used		280
Barrels of Ale		137
Barrels of Liquor boiled off		41
Makes Barrels of raw Worts		178
Barrels of Liquor absorbed	52	
Barrels of Blue Worts for next Day's brewing	50	
		102
The Whole of the Liquor accounted for ...		280

The Ale dropped fine in Ten Days, was uncommonly pale, spirituous, and bright; a Glass of it thrown in the Fire burned like Spirits.

	H. M.
Time of Mashing	3 30
Standing of the Tap	4 45
Time of Boiling	5 30
Time of Brewing	13 45

BOOK THE SECOND.

BREWING

FOR

DISTILLING.

SIDNEY, Printer, Northumberland-Street.

COMPARATIVE OBSERVATIONS

ON

MALTED AND UNMALTED CORN,

CONNECTED WITH

BREWING, DISTILLING, &c.

A WANT of due attention to the occurring phenomena during the process of malting, to the nature, quality, and properties of Malt; and not sufficiently considering the effect which caloric, or the matter of heat, invariably produces upon all bodies subjected to its action, have given rise to many erroneous and contradictory opinions upon a subject of considerable magnitude and importance.

The notion of malt having imbibed a greater or less quantity of fire at the kiln in drying, or after being removed,—that it contains any portion of that element, is absurd and unphilosophical;—that grain, however, in all its stages of conversion to malt, is materially acted upon and modified by heat, which imparts to it colour, flavour, and other distinctive properties, I readily grant.

To more effectually explode this erroneous doctrine, and to illustrate my ideas, I shall adduce such facts and evidence as, in my humble judgment, are applicable; which, though possibly not original, may

 not

not have hitherto been seen in an equally clear, or similar point of view.—This will naturally lead me into an enquiry which I shall abridge as much as possible, by introducing no more scientific matter than it absolutely demands.

First, let us examine into what is malting? In a former place I have classed it under fermentation. Here I will consider it as a species of vegetation, and endeavour to shew where the affinity between these important processes of nature lies, where they unite in the process of malting, and how they are conducive to its completion.

As no one who has given the subject a thought, disallows of vegetation being a part of the process, let us see how nature conducts it in the common mode of sowing grain for the re-production of its kind.

It has been already shewn, that wheat, rye, barley, &c. exclusive of the husk and bran, contain mucilage, saccharine matter, and animal gluten; and how they are disposed of by fermentation. It now remains to shew the manner of their operation in the vegetative process; how the artificial vegetation on the malt-floor conduces to the changes in raw corn; and to mark its progress through the process of malting; with a view to assign to profit and to loss their respective quotas; and to see where the balance lies. Not more anxious to do every justice to this momentous enquiry, than to be clearly comprehended, and to escape the charge of being unnecessarily tedious, I cannot help bewailing my want of that happy talent so rarely possessed, of conveying much matter in few words.

Nature seems to have deposited the mucilage in farinaceous plants for the nutriment of their infant progeny, in the early stage of their reproduction, when the embryo, as in animals, is too tender to assimilate those juices for their support, which afterwards serve to forward their growth to the usual perfection; and which, in grain, are drawn from

from the air, water, and earth ; but which, in its infantine period, are supplied by the native mucilage of the parent plant.

For this reason, nature has provided grain with a much greater proportion of this mucilage or vegetable milk, than with saccharine or viscous matter, which, in a pulverable state, is denominated farina; constituting the chief food of man and graniferous animals.

Without entering into the anatomical structure of a grain of corn in this short practical definition, it will be sufficient to remark the progressive course of nature in the reproduction of each species of grain; that in proportion as the germ of the plant, and the gradual formation of its organic parts or vessels, by which it must derive its future sustenance from the earth, air, and water, aided by the solar heat and light to which it is exposed, germinates, the mucilage of the parent grain is taken up to nourish it; and as these vessels increase in growth and strength in proportion to the decrease of the parent milk or mucilage, in an equal ratio it must be allowed to weaken the raw corn, or exhaust the substance of the grain in the progress of germination and its approach to a state of maturity.

This natural progress of vegetation, of which malting is a real, though an humble imitation, explains how much, and in what proportion, we consume the farina or flour of the grain we malt, in the ordinary process of malting.

We have, no doubt, been primarily led into this error from the superiority of perceptible sweetness which malted has over unmalted grain, forgetting that it was occasioned by fermentation; and from not knowing that vegetation in plants, and respiration in animals, are each properly a species of fermentation, all of which are different modes of decomposition which nature employs for the formation and de-formation of new substances, or the resolution and combination of matter,

matter, described under the Doctrine of Fermentation; and there defined to be various gradations of low-combustion, accompanied with the generation of heat equal to the degree of combustion; and with a heat always exceeding that of the ambient air; thence called an increase of temperature; so that a thermometer introduced into a living tree shall exceed the temperature of one exposed to the air hung against a wall, the temperature of the atmosphere being below 56 degrees; and this on the supposition that the wall cannot, from its situation, reflect the solar heat.

The superior degree of heat which respiration or animal heat, and the heat excited by vegetation and fermentation, have over the temperature of the surrounding atmosphere, is apparent to any one who has given the subject a moment's consideration; but that this augmentation of temperature arises from a kind of inferior combustion is not so generally known. Nor is it generally understood, that this species of insensible combustion is in matter a tendency to decomposition, having departed from the just poise which kept it in its preexistent state of equilibrium.

Fire, or actual combustion, requires pure air, that is oxygenous gas, for its existence and support; vegetation thrives in mephitic gas; and fixed air is the offspring of fermentation and low-combustion, generated by the decomposition and recomposition of the fermenting mass, while active combustion, or fire, produces foul, or phlogisticated air, that is, azotic gas, by the decomposition of the air of the atmosphere. Therefore, as neither of the leading processes of vegetation, malting, or fermentation, absorb pure air, nor require it for their existence or support in any other way than as it is extricated from the vegetating, malting, or fermenting matter, though they generate heat, they, nor the malt produced by them, cannot be said to imbibe fire, although they may be acted on by it.

We

We have seen, under Fermentation, that the air extricated is fixed air, or carbonic acid gas; and here it should be noted, that the air evolved from vegetation is vital air, or oxygen gas, if exposed to the sun's light; if not, carbonic gas, or fixed air; this serves to shew where these two great processes of nature are similar and dissimilar in their rise and progress; and that by one contaminating, and the other purifying the atmosphere, the operations of nature continue their existence, and the atmosphere, as well as all created matter, is resuscitated.

Fire converts wood and coal to charcoal, or carbon; it has the same effect on grain, malt, coffee, or any other vegetable matter. In fact, fire is the creature produced by vital or pure air, acting on any, or all, of the before-mentioned substances, in a state of combustion; therefore to imbibe fire would be to be oxygenated, or impregnated with pure air, and to be oxygenated, would be to be acidified in all fermented cases, and chared, or oxydated, in all others; the very thing we would wish to avoid in malting and in brewing, except in the production of vinegar, as shewn under that head in the Doctrine of Fermentation, which is an oxygenating or acidifying process. Hence, how inaccurate must the conclusion be, that malt contains any proportion or quantity of fire. All bodies, in proportion as they are more or less oxydated, or fired, become proportionably uninflammable, which it is evident grain, or malt, and all its products, are not, except when intended for vinegar. But, in proportion as malt has undergone oxygenating, or firing, it receives more or less color or flavor; as may be seen in the Preliminary Observations on Brewing, to which this paper may be considered as a Supplement. It is the effect, not the quality, of fire that malt retains, as the grain is altered by the action, and not by the retention.

Therefore, raw or unmalted corn is in full possession of all its beneficial properties, with the advantage of containing more carbon than malted corn, malting only retarding its advance towards acescency,
with

with a loss of fermentable matter proportioned to the extent of the malting, and subsequent drying, which does not sufficiently compensate the distiller or vinegar-brewer for such loss.

But, when malted in the gyle-tun, (if we may be allowed the expression) we have the whole strength and quality, with all the flavor fermentation can extract, which is a species of combustion, or malting, of the most profitable kind, yielding flavor in proportion to the extent of the attenuation. And the rest of the flavor may be obtained by the addition of some good amber, or brown malt, or, as hereafter to be noted, by changes to be previously induced on part of the grist, or by subsequent additions, all unexceptionably good and wholesome.

Raw malts, whether they are the result of a deficiency in the couch, or of growth on the floor, or of drying on the kiln, in proportion as they recede from an excess of either, approach to the nature and quality of raw corn, as is evident from their producing a length proportioned to that rawness; which superior length should have, ere this, suggested the application and use of raw corn in brewing; and probably would, had their gravity always corresponded with their length; demonstrable from their gravity increasing in proportion to the progress of the subsequent fermentation to its achme, or height, until the whole of its fermentable matter is developed, as in the preparation of sweets.

With respect to the immediate process of malting, and the occurring phenomena during that process, it is worthy of observation, that the liquor (i. e. water) in which it is steeped, receives a color proportionably higher from the barley or other grain infused, lighter or deeper correspondent to the time it is steeped, and the heat of the atmosphere during the infusion.

Color is not the only thing extracted from the grain steeped; as soon

as

as the water enters its pores, and especially in proportion as the grain expands, or increases in bulk, the gluten which has been found insoluble when separated by washing of a paste of flour in cold water, the analytical process employed for separating starch, is here, from the extreme division and dispersion of its parts throughout the farina, rendered soluble by part of that farina intimately combined with it in the substance of the grain, acting and re-acting as solvents on each other, thereby rendering the gluten soluble by steeping.

It is this animal gluten, with part of the saccharine matter, &c. that communicates the color to the liquor (or water) in which the grain is steeped, and in warm weather gives rise to the putrid fermentation to which this liquor is then so subject, from an increase of temperature and superabundance of animal matter, which renders it so extremely fœtid.

The separation of part of this gluten, which is the bond of cement to the component parts of the grain, and the introduction of the liquor (or water) into its pores, excites the beginning motion of those parts called vegetation, of which we have already spoken, and shewn to be somewhat similar in its effects to fermentation.

The time of steeping is varied by different malsters, and in different districts; sometimes for no good reason, at others, according as they are situated farther north, and frequently with the change of season, from forty to eighty hours.

The proportion of dry barley to the couch, is usually as four to five; that is, every four bushels of sound dry barley will become five, if properly wet for couching.

The proportion of barley is as five to eight, between the couch and the floor; that is, five couch bushels, will sometimes grow to eight before it is dried.

 I have

I have elsewhere observed, that the nearer the malt is reduced to the original measure of the barley, the better and fairer it is generally cured, all other requisites being at the same time complied with.

Let us now see how the properties of barley or other grain are altered by malting? What are the advantages derived from this process, or what more this species of fermentation does for us?

It is wished to be impressed on the mind of the reader, that barley or other grain consists of a small portion of saccharine matter, a large quantity of animal gluten, and a very large portion of mucilage; these three compose the whole of the farina of the grain, independent of the bran, husk, or other ligneous parts; these three substances, taken together, are usually denominated the fermentable matter.

While in a state of barley, wheat, &c. the saccharine matter is involved in the gluten, so as not to be perceptible until developed by malting. The mucilage, which consists of the whole farina, or flour, of the grain, except the saccharine and glutenous part, the latter of which is most considerable in wheat, next in rye, barley, &c., is separable under the form of gluten, as the former is under the form of starch. It should be here remarked, that malted corn does not produce starch; and that the starchy part eludes the compound acid and fœtid fermentation generated in the making of starch, which decomposes and dissolves the other two component parts.

It is elsewhere shewn, that the process of malting is a vegetative degree of fermentation, which resolves the glutenous, and unfolds the saccharine matter. This kind of vegetative fermentative process, may be truly stiled the first stage of decomposition, in which the whole principles of the grain are blended, or more uniformly mixed for facilitating the process of fermentation, or immediate attenuation.

But

But the fermentation of unmalted corn, which has been previously prepared by brewing, giving an increase of gravity for some days after the fermentation has commenced, proves the practicability of malting in the gyle-tun, and supersedes the previous malting, confirmed by the perceptible sweetness during such increase of gravity.

When the doctrine of fermentation was less understood than it is even now, malting was a grand and beneficial discovery; and, like many other things, we may probably have owed it to accident; such as grain getting wet at harvest time, or in the carriage, on board ship, heating and developing its sweetness. This has frequently happened to bread-corn, and always diminishes the quantity of flour, independent of giving it a malty or sweetish taste.

Moisture and heat are the parents of corruption, and the agents employed by nature in the decomposition of vegetable and animal substances, to which the vinous, acetous, and putrid processes of fermentation owe their existence.

Distinctively, the saccharine principle is productive of the vinous; the gluten of the putrid; and the mucilage of the vinous and acetous process of fermentation; as described more at large under the Doctrine of Fermentation.

The obvious intention of malting should seem to be a development of the saccharine matter, and a resolution of the gluten in which it is involved, in order to dispose the mucilage to ferment, by causing the whole of the farina to dissolve in the liquors turned over at the requisite heat, for the length previously determined on.

For purposes answering this end malting has become an established process preparatory to brewing; which experience has improved from brown to amber, and from amber to pale malt; and which we expect

 will

will one day or other ultimately improve to the more simple, and infinitely more beneficial, mode of the immediate use of the barley or raw corn, from which the present raw malts are not many removes, with respect to the effect the fire, or subsequent drying, has on them: the malted, under such circumstances, having no advantage over the unmalted grain, other than an insipient tendency to solution and fermentation.

This will prove infinitely more easy to effect than is generally imagined; old prejudices not being easily removed. With respect to those whose prejudices are deep-rooted, I wish to inform them, that the business of malting should in future be performed in the gyle-tun, or fermenting-back; and that upon the whole substance of the grain; but not in the slovenly manner of the Dutch;—the present mode of malting exhausting the strength of the grain, both actually and relatively; actually in the process of vegetating the radicals, and sending forth the acrospire; and relatively, in subtracting part of its weight and strength, with a considerable increase of the bulk in some malts, to the evident decrease of the farina wasted in the steeping and growth of the grain malted, as previously demonstrated.

And what is gained in return for this decrease of strength, and subduction of quantity of fermentable matter, I would ask, that can compensate for the absolute impoverishment of the wort and wash, and subsequent decrease of length when brewed, and of spirit when distilled?

What is badly malted, or partially malted, grain, but worse mixtures of malted and unmalted corn, than can possibly be obtained from the use of mixtures of malted and unmalted grain? Whatever the difference may be, it must be in favor of the latter more certain

practice.

practice. Hence the mode I propose of malting in the gyle-tun, or fermenting-back, must, from being more uniformly certain, be infinitely preferable, less troublesome, and more expeditious.

The gluten, we have seen, is soluble in cold water, evinced in the steeping of barley or other grain for malting; it will be elsewhere shewn, that it is in a great degree soluble by fermentation, as we have shewn it to be in that species of vegetation the grain undergoes on the floor of the malt-house, and in that species of fermentation hinted at in starch-making.

The mucilage, or starch of the farina, liberated by the solution of its gluten, is not soluble in cold water, evinced by the making of starch, nor materially acted on by the subsequent acid and fœtid fermentation which resolves the gluten and saccharine matter, the latter being also soluble in cold water and totally dissoluble by fermentation.

Such part of the farina or flour of the raw or malted corn as is not dissolved by the heat of the liquor turned over, particularly in the first mash, from not submitting to the subsequent heat and action of fermentation, is lost to both the vinegar brewer and distiller, with respect to its solubility in the wort or wash, and its subsequent spirituosity: the gluten and saccharum of such parts of it being fully dissolved, and the mucilage or starchy part of it that remains undissolved (as before observed) eluding fermentation in the gyle-tun or fermenting-back, as now managed.

The only proof of the solubility of the whole of the farina, is the transparency of the solution in the under-back of the mash-tun; therefore milky worts and wash are imperfect; in such, part of the farina is diffused or suspended, but not dissolved. That suspension being but temporary, the undissolved part separates and falls to the bottom of the cooler, &c. the pure mucilage of which is inevitably lost,

lost, though it were even swept down into the tun or back, from its eluding the action of fermentation when there.

Hence the falacious, unfrugal, and unscientific mode of work pursued by the distiller, in making from an eighth to a quarter part of the wash into lobb; not because the whole of the grain, bran, and grains are all mixed up together, instead of extracting the fermentable matter by brewing, under the form of wort; but by reason of the insolubility of it in the liquor for want of a proper heat, and the subsequent loss of the undissolved part, as herein stated; for, as before observed, fermentation, however properly conducted, is unequal to the attenuation of the whole of the fermentable matter, in this undissolved state.

I no more object to the lobb, merely from its being lobb, than to the wash from having the grains diffused through it, by which its transparency would be prevented: far otherwise; I would make nothing but lobb, but with such a heat as would secure the dissolution of the whole of the fermentable matter, and in such a way as the meanest brewer could not err, provided he followed the easy, uniform, and simple mode of work, to be introduced presently; which he might do without the smallest danger of what is called setting of the goods, viz.

To grind low; mash with the shortest liquor possible, moderately low, and mingle the whole up together with as much hot liquor, at a heat that would insure the dissolution of all the fermentable matter, at the requisite length, and ferment the whole together in a state of lobb; and by this means reduce the two operations of brewing and fermenting to one process.

For instance, I would take from one-fourth to one-third of malted grain at most, and three-fourths or two-thirds of unmalted at least. For

For example, twenty quarters of the former, and forty of the latter, ground low or fine, and wet with from sixty to ninety barrels of liquor, at a certain moderately low heat, to make as dry or stiff a mash as possible, in a mash-tun without a false bottom.

To which I would add from two hundred to two hundred and fifty barrels more of liquor, brought nearly or quite through, or as much below or above the boiling heat as would suit my purpose, by means of an inclosed copper to form the requisite heat for the perfect solution of the whole of the fermentable matter into a transparent state, which might be judged of by drawing a sample and suffering the gross parts to subside, for ascertaining both gravity and transparency. The bran diffused through the fluid differing in appearance from a similar diffusion of the farina, would be easy distinguished while suspended, or ascertained when precipitated.

Thus having judiciously obtained a perfect solution of all the soluble parts, when cooled to the requisite temperature, I would let them down into the fermenting backs, and pitch at a moderately low temperature, either with the usual quantity of yeast, according to the old mode, or with the transfer of the superfluous fixed air of those backs they were destined to succeed, and save the whole of the yeast, (by a new mode of work) now lavished on this process, both in the pitching and in the subsequent rousings, to the no-small saving of the fugitive spirit, now inevitably dissipated with the present escape of fixed air, as previously pointed out in the Doctrine of Fermentation.

When the worts have sunk in the coolers to a fermentable heat, let down in the gyle-tun, and pitched with a due proportion of live yeast, or impregnated, as before suggested, with the fixed air of the neighbouring backs or gyle-tuns; the specific gravity taken every six, eight, or twelve hours, to ascertain the progress of increasing gravity or strength, and the consequent development of the saccharine matter,

the

the positions I have advanced will be supported by evidence founded upon facts.

By this effectual mode of malting in the gyle-tun or fermentating-back, and frugal reduction of the processes of mashing, brewing, and fermenting, to one operation, there could be no danger, from the frequent evil of any deposition of unmalted or indissoluble particles on the bottom of the still, of burning, or injuring the low wines, as at present. In fact, the whole of the flour being dissolved and fully fermented, there are no particles in the fluid incapable of floating; for though heat expands, yet heat, being the principle of levity, would suspend them.

In the first place, *Raw Corn* does not give gravity to the worts in any certain proportion to its real strength, by the common process of brewing, therefore not ascertainable by the hydrometer, like malted corn, and consequently only to be learned from experience, or a number of judicious experiments, carefully attended to under the regulation of an exact thermometer and hydrometer, during the whole of the fermentation, as it at first increases, secondly is stationary, and then decreases in gravity. Even then, *raw corn* eludes enquiry merely made with instruments, and nothing less than a long and operose fermentation, followed by distillation, can ascertain it.

From long observation, derived from experience, I find the best barley grists fluctuate in strength, or gravity, from ninety to one hundred and twenty pounds per quarter, that is, the spirit procurable from them is equal to such a gravity of fermentable matter, although they do not, in reality, give any such specific gravity to the worts, or wash, immediately drawn from them. The fact is, these same barleys, when malted, give a greater gravity to the liquor *turned over*, than they did when brewed as unmalted barleys. Yet, what is very surprising, they give a much greater strength, though less weight, than when malted, and that in the proportions above-mentioned; that is, the best malted barleys, denoting by the hydrometer to contain from seventy-five to ninety pounds per quarter, when brewed as *raw corn*, are equal in strength, if judiciously managed, from ninety to one hundred and twenty pounds per quarter.

It is well known, that raw malts yield the greatest gravity, the increase of which is in proportion to their rawness, provided the barley was equally good before malted. *See Preliminary Observations on Brewing, Malting in the Gyle Tun, and the annexed Malt Distillers' Tables.*

MALT DISTILLING.

THE PROCESS.

TAKE sixty quarters of *Barley Grist*, ground low, and thirty quarters of *Pale Malt*, ground rather coarse, and brew agreeable to the Table, No. I. Make your *Lob* with ten quarters of the malt, ground into coarse flour, and thirty barrels of *Liquor*, at the *heat* of 170 degrees, row or blend them into a uniform mass, and mix them thoroughly with the major part of the first *Wort*, and pump them up together into the coolers; when cooled to the temperature of 55 degrees, they are to be let down into the *Fermenting-back* to the reserved part of the first worts, say thirty barrels, previously *pitched* at 60 degrees, with ten store of fresh porter yeast, which, with the rest of the worts, at 55 degrees, altogether compose a back of distillers' wash.

Proceed according to the regular gradation progressively pointed out in the Table. Take the specific gravity of the worts previous to their descent into the backs, and before any yeast is added, and note it down in the Table; this do every twelve hours, for three or four days, during which it may be found to increase in gravity and sweetness,

ness, from the augmenting force of the fermentation, resolving the gluten, and extracting the saccharine matter. This is malting in the gyle-tun, or fermenting-back.

When the gravity seems to be stationary, or rather decreasing, a vinous tartness will begin to succeed the previous sweetness, the fermentation become more vigourous, and the gravity more rapidly decrease; before it arrives at this period, a sensible decrease of gravity, and a conspicuous change of flavour from sweet to tart usually takes place. Closely observe every change and appearance in the fermentation, and note it down in the column in the Table left for remarks, independent of the operations that have their respective columns assigned to them.

After the *Rousing* and *Cutting*, noted in the Table, and usually in twelve or fourteen days, the yeasty head will fall quite flat, which denotes the fermentation being nearly over. If the heat appears, by the thermometer, to drop, and the fermentation has gone on well; or if the *attenuation* appears, by the hydrometer, to have reduced the gravity of the wash from its original weight of twenty-eight, thirty, or a greater number of pounds to two, three, or four pounds per barrel, and the wash should have a vinous odour and flavour, then all is right.

At this period some add twenty pounds of common salt, and thirty pounds of flour, rouse and keep the fermenting-back close, as it should have been during the whole process. In three or four days it will taste quite tart, and should be immediately distilled. *See Distiller's Table,* No. I.

The officers of excise estimate six gallons of wash to produce one gallon of spirit, at one to ten over proof, and usually strike the excise on each brewing accordingly. And, for instance, compute that 90 quarters of grain, yielding about 270 barrels, or 9720 gallons of wash,

 produce

produce 1620 gallons of spirit, at one to ten over proof; that is, 18 gallons per quarter at that strength. This is estimating at 108 gallons, or three barrels of wash, to each quarter of grain, and taking the produce of spirit at 18 gallons per quarter, as before observed.

The malt distiller, however, usually draws but two and a half barrels per quarter, which is 225 barrels, or 8100 gallons of wash, on this quantity of grain, instead of 170 barrels, *(i. e.)* 9720 gallons, from which he sometimes extracts nearly 1800 gallons of spirit, at one to ten over proof, instead of 1620 gallons, as computed by the officer, agreeable to the excise laws relating to distilling; thinking himself but badly off when he cannot obtain full 18 gallons of spirit of this strength from every quarter of grain brewed. This, by the officers' computation, would be a length of three barrels per quarter, which, on a grist of 90 quarters, would be but 270 barrels; whereas 1800 gallons of spirit implies 100 quarters of grain in the grist, and 10,800 gallons, or 300 barrels of wash, at six gallons of wash to one of spirit. This would make a difference in the computation of the grist of, from ten to 25 quarters; in the wash of 2700 gallons, and in the spirit produced, of 450 gallons; and might turn out nearly so, were the best grain always brewed, which is not the case. To avoid paying an over proportion of excise, he is compelled to draw no greater length than 225, instead of 270 barrels of wash, and extracting a produce equal to 300 barrels drawn from 100 quarters. By this method of work, of which the officer is ignorant, he has a produce of 1800, instead of 1350 gallons of spirit, by concentrating as much fermentable matter or strength in 8100 gallons of wash, as the excise compute obtainable from no less quantity then 10,800, which is obtaining a gallon of spirit from four gallons and a half of wash, or three-fourths of the allowed or computed quantity; not with a view to defraud the excise, but necessarily to avoid being over charged in the wash, as he pays the excise on the redundent spirit, the officer stricking the excise where it is most advantageous to the crown.

From

From these observations, derived from experience, it must be obvious, the distiller is under the necessity of pursuing this mode of work, though highly injurious to the spirit, from being so fettered by the excise; pursuing the lesser to avoid the greater evil.

The wash, duly fermented, is committed to the still; all the time it is running in, it should be roused up, or agitated in the fermenting back, by a *Stirring Engine,* to mix the thick and thin parts together into one homogeneous mass, and enable it to be sufficiently fluid to flow into the still; where it is kept fluid by the *Stirring Engine* of the still, until it boils, when the agitation of the boiling usually keeps it from *burning* and imparting an *emperumatic* or burnt flavour to the *low wines*; which taint will inevitably rise from the low wines in the *Spirit Still,* during the doubling or distilling of the spirits of the second extraction.

This spirit is usually sold by weight, delivered to the rectifying distiller at one to ten over proof, who rectifies, or distills it over again, combining it with certain ingredients in order to clarify it from its gross oil and other impurities, with the view to render it fit for making into *gin,* brandy, rum, or cordial compounds, which he sells to the public at a strength of one in five per gallon under proof. *See Rectification.*

The rivalship for excellence among the malt-distillers, who do not very cordially concur in their operations, obliged them to employ ingredients to overcome the fœtid odour of their spirits, unavoidably arising from the gross oil of the grain, proceeding from the rich *wash* they are obliged to make, compelled from the manner in which the excise laws are framed; but they all agree in the necessity there is of getting rid of it one way or other. This might be remedied, in a great degree, by blending certain substance with the feints, and rectifying them with a still and worm, appropriated to that purpose only, which would more considerably add to the purity of the spirit, than any subsequent rectification.

The

The alkaline quality of most of the ingredients employed, either by the malt distiller or rectifier, while they, in a small degree, attract the gross oil and also part of the volatile resinous matter that renders the spirit impure, and with them both together form a saponacious substance that does not wholly raise in this kind of distillation, destroy a considerable part of the volatile saline substance, to which malt spirit owes its vinosity. A remedy as bad as the evil it is intended to remove.

Oil of Vitriol would prove a cheaper, and a much more efficacious purifier of the spirit, if this potent acid was cautiously added to the wash immediately after it was pumped up or let down into the still, in a quarter of the quantity by weight, that alkaline substances are commonly used: by forming a more considerable part of the oliaginous and resinous parts of the wash into a saponacious matter, and creating in stead of destroying a great quantity of the volatile saline matter, to which spirits owe their vinosity and delicate flavour.

Nitrous Salts, in a quarter of the quantity by weight, added to the low-wines as soon as they were pumped into the still, would much more effectually improve the flavour and quality of the spirit, by giving that kind of purity that would specifically answer the purpose of increase in quantity: This they would do by separating any part of the vitriolic acid, rendered volatile by the levity of some part of the saponacious matter, before-mentioned, at the same time, and in an equal proportion, neutralize the nitrous salts, liberating a *spiritus nitri dulcis,* of which more hereafter.

This mode of work, with the addition of those acid and neutral saline substances, renders the spirit produced, not only more palatable, but also more wholesome than the additions hitherto used, and perfectly salubrious to the swine and cattle who consume the spent-wash as part of their food, and make the fat of both much firmer without the expensive

pensive addition of peas or bean-meal to the food of the former, or so much of the dry food usually given to the latter for this purpose. Advantages not to be lost sight of by the malt distiller.

The feints, or after-runnings, from the wash-still, are usually added to the next distillation of the wash; a practice commonly pursued from the commencement to the conclusion of the distilling season, receving and imparting to the spirit produced, in an increasing degree, the nauseous and odious smell and flavour, so well known to both malt-distiller and rectifier; a depravity increasing in quality, in proportion to its accumulating quantity of spirit obtained during the whole of the season; is an evil that has never yet been overcome, nor never can, by the means hitherto pursued.

In the Feint Still, the vitriolic acid will prove eminently useful, and in a duplicate proportion to what I have proposed to be added in the wash-still. Charcoal in double the weight of the acid recommended, may be also advantageously added; which, by floating in the feints, will entangle the more volatile part of the gross oil which visciated them, and partially prevent its coming over the helm, while the denser and grosser part of this oil is detained in the still, under the saponacious form before mentioned. They will be then a more fit addition to the low wines.

The feints, or after-runnings from the spirit still, should be saved until there is enough for a charge, and distilled with the same precautions and additions in the spirit still. The purity and strength of the spirit obtained, will amply repay the trouble and expence. Purity is strength. Depravity gives gravity to the distiller's loss. Purity gives levity to the distiller's gain, the former being the hydrometrical measure of strength, and the latter of weakness, by which their comparative value is ascertained, under the assistant regulation of the thermometer.

The

The wash being of a mucilaginous nature, a peculiar management we have seen, has been found necessay to prevent its burning, and cause it to work kindly in the still: if it should happen to be burnt in the operation, the spirit will have a most disagreeable flavour, which can hardly ever be removed; therefore, to prevent this accident, the stirring engine becomes an essential addition to the wash-still; the distiller, as before observed, being compelled, from the nature of the excise laws, to prepare his wash sufficiently thick and undilute to avoid paying an over proportion of duty, guards against its burning, by the agitation of the gross wash with the still-engine, and a well-regulated fire, carefully attended to during the whole of the distilling process. In the early part of the operation, the incautiously throwing on fresh fuel, or hastily stirring or breaking up the fire, may cause the wash to run foul or boil over into the condensor or worm, which would also very much injure the flavour and scent of the spirit, and which cannot be well prevented but by those precautions, and working the engine during the whole of the process, when the wash works unkindly.

In Holland the malt-distillers work their wash thick, as they call it, but it is really very dilute, compared to ours, although the whole body of the malt, ground to a coarse meal, is distilled with it; the avoiding a burnt empyrumæ they attribute to the keeping their sills clean, and their being so regularly nice in the management of their fires, that they use no artifice at all on this head, only charge the still while it is hot and moist, so that they very rarely have the misfortune to scorch the wash or burn the still, except now and then, in the very depth of winter, when the frost in extremely severe indeed.

But their stills are not near the magnitude of ours, and consequently less exposed to these accidents. The method here proposed, and the additions recommended will, in proper hands, sufficiently prevent these accidents, and others of a more dangerous tendency, such as burning a hole in the bottom of the wash-still, blowing off the head or of

setting

setting the still on fire, misfortunes ruinous and destructive in the extreme. When the wash happens, notwithstanding all our care, to burn, the repetition of it, in the succeeding operations, is prevented by carefully scraping, scrubbing, and scowering of the remains of the burnt matter.

THE DOCTRINE OF FERMENTATION SCIENTIFICALLY REDUCED TO PRACTICE.

Position the First.

100 Tuns of Alkohol contains		
Hydrogen	—	8 Tuns
Carbon	—	28
Oxygen	—	64
Alkohol	— —	100 Tuns

100 Tuns of Water contains		
Hydrogen	—	15 Tuns
Oxygen	—	85
Water	— —	100 Tuns

Position the Second.

100 Tuns of Proof Spirit contains		
Hydrogen	—	4 Tuns
Carbon	—	14
Oxygen	—	82
Proof Spirit	—	100 Tuns

Or, Conjunctively 100 Tuns of Proof Spirit contains in the		
Hydrogen of the Water	$7\frac{1}{2}$ Tuns	
In the Alkohol Ditto	4	
Hydrogen	—	$11\frac{1}{2}$
Oxygen of the Water	$42\frac{1}{2}$	
Ditto of the Alkohol	42	
Oxygen	——	$74\frac{1}{2}$
Carbon of the Alkohol	—	14
Real Component Parts of Proof Spirit, in		100 Tuns

It appears by those positions, that upon the subduction of Hydrogen and increase of Carbon depends the formation of spirit compared with water, as in position the first. It also appears, that every subduction of hydrogen below that of reducing water to alkohol, as in position the second, is a reduction of spirituosity, or strength.

It must occur to accurate observers of these remarks, that the decomposition of water is necessary to the composition of alkohol, or spirit, with the interposition of carbon. It occurs to me, that the decomposition of hydrogen and oxygen of the water of fluidity goes on with the decomposition of the interposed carbon, or fermentable matter, added.

The usual quantity of fermentable matter added by the brewer for ale, strong beer, and table-beer is comparatively small to the quantity of carbon, or fermentable matter, with which the water of fluidity is charged by the malt-distiller. It is in a ratio from ten to twenty-five or thirty pounds per barrel, on the best table-beer, two-penny, porter, strong-beer, ale, and strong ale; with the distillers it is from twenty-five, to thirty, and forty pounds per barrel.

Or, rather, the abstraction of hydrogen, and addition of carbon is the cause of *converting water to wine,* ale, beer, distillable wash, and spirits, by the means of fermentation.

By position the first, one hundred tuns of water consists of fifteen tuns of hydrogen, and eighty-five tuns of oxygen; the greatest quantity of hydrogen and oxygen that is capable of preserving a state of equilibrium under that form. Water saturated with its bulk of carbonic acid gas, assumes a pungent briskness, and a slight, but pleasing acidity, that conjointly gives a flavour to the water, bordering upon vinosity, or slight spirituosity; although this addition of

of carbon is comparatively small by weight, compared to that which wine, beer, ale, or proof spirit contains in equilibrium.

This impregnation of carbonic acid gas soon evaporates, if not kept close corked or bunged up. A proof that it is not become a part of the fluid with which it is only blended, for want of the addition of fermentable matter, the only *intermedium* for carbon in a gaseous state, within our present knowledge, that can disturb the equilibrium of the water of fluidity, that is, of the mere water, which is the basis of all liquids, and much higher hydrogenated than any of the vinous or spirituous kind of fluids.

All fermentable matter abounds with carbon principally; secondly, oxygen; and lastly, hydrogen.

All substances containing oxygen, or carbon in a loose state, or mixtures of them, are ferments, and accordingly excite and promote fermentation in aqueous liquors containing fermentable matter in an unfermented state. They break the equilibrium and cohesion of the particles of the fermentable matter, and disturb the equilibrium of the water of fluidity; attenuate the compound fluid, resolve and divide its component parts, and recombine them into new substances, of which vinosity is the result.

Part of the oxygen of the water of fluidity combines with part of the carbon of the fermentable matter, and by the assistance of caloric, or matter of heat, resulting from the decomposition of the compound fluid arising from the intestine motion excited by low-combustion, ascend under the elastic form of carbonic acid gas.

This low-combustion, called fermentation, is supported at the expence of part of the hydrogen wihch is consumed, that is, united with part of the oxygen into water, to supply the waste, or com-

 position

position of the water of fluidity decomposed; while another part of the carbon and hydrogen unite with a portion of the oxygen into vinosity, or spirituosity. Here is a decomposition and recomposition of water, and a generation of a new substance, vinosity.

Constituting a second equilibrium by a new arrangement of particles, which proves the indistructibility of matter, changing the character of the fluid, by converting water to wine. Hence the term vinosity. Of all which, fermentation, or low-combustion, is the instrument, and attenuation, or a reduction of the weight of the compound fluid, the result, which becomes lighter in proportion to its increase of vinosity, or spirituosity; which before was heavier than water in proportion to the charge of fermentable matter, anh which becomes lighter than water in proportion to its attenuation, and consequent augmentation of vinosity.

Here it is to be carefully attended to, that there is no addition of hydrogen, but a reduction of it. No addition of oxygen, but a reduction of it. Hence the vinous fermentation succeeds best in close vessels.

And the low-combustion of fermentation is similar to the active combustion of charcoal, wood, and other vegetable matter, in oxygen gas, the result of all which is carbonic gas, in proportion to the extent of the combustion, and consumption of oxygen. And in proportion to the extent of the low-combustion of fermentation, and the consumption of hydrogen, the pabulum of low-combustion, spirit, and water is formed.

Evidently, the only additional spirit causing substance, is carbon; and the more the fluid is saturated with carbon in specie duly combined, with an equiliberating portion of hydrogen and oxygen, the more spirituous that fluid becomes. And the more it is dehydrogenated,

genated, and deoxygenated; the more it is capable of taking up carbon, and the higher it is carbonated, the nearer it approaches to alkohol: hence *carbon*, and not *hydrogen*, as has been mistakenly thought, is the cause of spirituosity. Therefore, we should in future endeavour to prevent its escape under the form of carbonic acid gas. Or, supply a redundance equal to that escape, and filter it in its flight of the fugitive alkohol, by passing it through an intermediate substance capable of intercepting or absorbing it.

Or, this may be attempted by keeping down the heat excited in the fermenting fluid by the intestine motion of low-combustion, that there may not be caloric to spare, to give a gaseous or elastic form to the carbon and oxygen, or by causing the superfluous oxygen to find hydrogen enough for its combustion to form water, or cause it to ascend alone, under the form of oxygen gas, as is the case in vegetation, which excites the least caloric possible in its low-combustion: by managing that, there should be no superfluous carbon to form carbonic acid gas, yet no want of carbon to form spirituosity.

The constituent elements of the fermenting fluid being disunited, and their equilibrium overturned by this kind of combustion, the affinities of its component parts, assisted by the intestine motion and heat generated, bringing them within the sphere of each others attraction reunite them into new substances, as before mentioned, to be the result of fermentation, or vinous combustion.

Carbonic gas, the result of the combustion of vegetables in oxygen gas; carbonic gas, the result also of vegetable or fermentable matter, by the combustion of vinosity, or the combustion of fermentation in its progress to vinosity, or low-combustion; which is the combustion of the hydrogen of their fermentable matter in oxygen gas; can proceed no farther than while there is hydrogen to supply it, or what is the same thing, fresh hydrogen thrown in, under the form of fermentable matter,

matter, or in a form capable of being decomposed by the combustion of fermentation. And this combustion, we have seen, is attenuation, and the elastic fluid, extricated carbonic acid gas, which carries off in its flight part of the new-formed spirit, partly in a nascent state, and partly under the form of alkohol in a gaseous state.

For, where the combustion of vinosity or inflammability ends, the combustion of uninflammability, or acidity, commences. This is an incontrovertible maxim in chemical phylosophy. During the combustion of the hydrogen of fermentable matter, part of the hydrogen of the water of fluidity is also consumed, and, as before observed, new water formed by these combustions with a due proportion of oxygen. So that either water is necessarily formed in abundance, or carbonic acid gas in the usual quantity.

Hence the combustion of vinosity is a dehydrogenation, and deoxygenation of the fermenting fluid, and at the same time a carbonation of it, as before-mentioned. And hence the combustion of acidity or inflammability, is both an oxygenation and carbonation of the fermenting fluid, and the elastic fluids thrown off or extricated, are azotic and carbonic gas, and principally the former. They carry off part of the new-formed acid with them, partly in a nascent state, and partly under the form of *azotic gas.*

And hence also it seems, that these different substances will continue to be the produce of the vinous, and acetous fermentations in the common way that nature makes use of these means in the decomposition of matter.

The hydrogen and oxygen proving to be the combustive materials of vinous combustion; carbon and oxygen the basis of vinosity, or the vinous product, combined with a portion of hydrogen, proportionably less than water contains, and proportionably strong, as it contains

contains more carbon and less hydrogen. See position the first and second. And the elastic fluid thrown off, carbonic acid gas consisting of oxygen and carbon, and alkohol in a nascent state. This last being composed of oxygen, carbon and hydrogen. Means should be resorted to, to enable nature, during these decompositions, to exhaust less hydrogen, and absorb more carbon.

The acetous fermentation, or acid combustion, is a further combustion of the hydrogen of the water of fluidity, and part of the hydrogen composing the vinosity of the fermenting mass, with a further oxygenation of the compound fluid, and the attenuation of the carbon of its composition, which, in proportion to its quantity, fixes a greater or lesser portion of oxygen. On the extent of this fixation of oxygen depends the increase of acidity, which must always be governed by the superiority of the carbon in quantity, to the hydrogen in the vinous fluid submitted to acidification.

Here there is not only a decomposition of a part of the water of fluidity but of the air of the incumbent atmosphere. It is this decomposition of the atmospheric air that furnishes the azotic, or nitrogen gas thrown off; and the further decomposition of the contained carbon that yields the carbonic acid gas, which is small in proportion to the discharge of the former, most of the carbon being fixed by the oxygen, absorbed partly from the atmosphere, and partly from the decomposition of the water of fluidity. This points out the necessity of carrying on this process of fermentation in open vessels.

Hence the stronger wines and worts are, and more spirituous, the stronger the subsequent vinegar proves. The carbon in the composition of their vinosity abounding in proportion to their spirituosity. Therefore, carbon is the basis of the strength of acidity of vinegar, as well as of the strength or vinosity of all vinous fluids and spirits. And hydrogen principally the fuel consumed in the combustion.

From

From these observations we may gather, that a redundance of oxygen may, in some degree, prove a superfluous principle in vinous combustion, and the cause of the waste of carbon. Therefore the less fermentable matter abound with it, the stronger will be the vinous product of that fermentation. And, consequently, there can be no good reason for admitting the air of the atmosphere, which consists of twenty-seven parts of oxygen and seventy-three of azot in one hundred parts. But a very good reason for admitting substances holding carbon in so loose a state, as to be separable by the low combustion of the fermenting fluid, as carbon dissolved in the gas of oxygen, hydrogen, or azot, or in mixtures of any two of them.

Nitric acid consists of seventy-nine and an half parts of oxygen, and twenty-one and an half of azot. Azotic gas, of azot and caloric. Water of fifteen parts of hydrogen, and eighty-five of oxygen. Aqeuous vapour of nearly the same portions of hydrogen and oxygen, and a portion of caloric. Hydrogen gas of hydrogen and a large portion of caloric. Hence the heat in fermenting fluids from its combustion.

We also gather from these observations, that there cannot well be too much oxygen in the composition of the compound fluid in its progress from the vinous to the acetous fermentation, nor too much carbon to combine with it into acidity; and the less azot in its composition the better, as it carries off acetic gas in its flight, combined with the azot of the atmosphere and heat, under the form of azotic gas, as before stated.

Or what is still better, avoid the previous vinous combustion, and pass the carbonaceous hydrogen and oxygenous fluid immediately to the acetous process of fermentation, that is, without the intermediate state of vinosity. Hence carbon and oxygen are only necessary to the formation of the acetous acid, the water of fluidity containing hydrogen

drogen enough, when once the equilibrium of its elements are broken, to carry on or support the acetous combustion. Here the oxygen and hydrogen are concentrated with the carbon into acidity, instead of forming carbonic gas and water, and hence the acid fluid contracts instead of expanding, as the vinous fluid is known to do in the act of combustion, the probable cause of uninflammability in one, and flammability in the other. We may compare the *vinous combustion* to the combustion of wood for charcoal, where the hydrogen and oxygen slowly burn and consume each other, while the carbon is concentrated into charcoal, and the *acetous combustion* to the burning of the carbon, or charcoal, in oxygen gas; which, where the air of the atmosphere excluded, the elastic fluid produced from both would be carbonic gas, but the air of the atmosphere being admitted to support the acetous combustion, the carbon is fixed, and the elastic fluid produced is principally azotic gas, the oxygen of the atmospheric air being absorbed and fixed in the acidifying fluid. As carbon dissolves in azotic gas, here is a large field for improving the quality and strength of vinegar. And in a less degree, the strength of vinous fluids preparing for wine, beer, cyder, or spirits.

Carbon dissolves in hydrogen gas. Carbonic gas expels hydrogen gas from metals. Hydrogen gas revives the calx of metals in the temperature of the atmosphere. Hence the escape of carbonic acid gas from fermenting fluids may be advantageously applied to expel hydrogen gas from iron, zinc, &c. in a divided state, as in shavings, wire, &c.; and the hydrogen gas, so obtained, to dissolve carbon in specie, and unite it with fermenting fluids. And when oxygen is wanting, hydrogen gas may be employed to revive the calx of iron, or any other metal abounding with oxygen. Therefore, fermentation may be made the instrument of supplying several intermedia, and many of the requisites of its respective improvements, both in the vinous and acetous processes. Hydrogen gas may be also advantage-

ously employed to precipitate the discolouration, or impregnation, of spirits, wines, beer, or cyder, caused by iron, or other metals, and the impregnations of arsenic and lead. Hydrogen is in a loose state in *hepar sulphur,* a solution of which instantly counteracts the deleterious and poisonous qualities of arsenic, and revives the calx of lead. The vitriolic acid and vitriolic air, or gas, most copiously expels hydrogen gas from iron, zinc, &c. and in the purest state. Hydrogen gas is of an alkaline quality, and arestible by acids in a liquid, fluid, and elastic state. It mingles with carbonic acid gas, but does not unite without a liquid intermedium. Hence carbon is soluble in hydrogen gas, and carbonic and hydrogen gas unitable by liquid intermedia, and by an equilibriate portion of oxygen, and may be formed by low-combustion into vinosity, or spirituosity.

COMPONENT PARTS OF PROOF SPIRIT;

Or, Position the Third, or rather a Repetition of Position the Second, more accurately stated: Comprising One Hundred Tuns of Proof Spirit.

Water 50 Tuns.			Alkohol 50 Tuns.		
Hydrogen	—	$7\frac{1}{2}$ Tuns	Hydrogen	—	4 Tuns
Oxygen	—	$42\frac{1}{2}$	Oxygen	—	32
Carbon	—	0	Carbon	—	14
		Water 50 Tuns			Alkohol 50 Tnns

Conjunctively.

CONJUNCTIVELY.

Hydrogen of the Water	—	$7\frac{1}{2}$ Tuns		
Ditto of the Alkohol	—	4		
Conjunctively	—		$11\frac{1}{2}$ Tuns	Hydrogen
Oxygen of the Water	—	$42\frac{1}{2}$ Tuns		
Ditto of the Alkohol	—	32		
Conjunctively	—		$74\frac{1}{2}$	Oxygen
Carbon of Ditto	— — — —		14	

Component Parts of Proof Spirit in 100 Tuns

It appears by these positions, as above rectified, that upon the increase of hydrogen, and the addition of carbon depends the production of vinosity in fermenting fluids, to which the superaddition of oxygen has hitherto been thought indispensably necessary.

It also appears, that the increase of spirituosity in vinous fluids depends upon the augmentation of carbon, and the combustive decrease of hydrogen and oxygen in these fluids; and that it is only in proportion to the increase of the former, and decrease of the two latter, that the augmentation of vinosity in vinous fluids depends. And that there is no other natural means of effecting this desirable purpose, but by such augmentation and diminution during the process of fermentation, ascertainable by subsequent distillation: the former being the instrument of its formation in, and the latter of its separation from, the water of fluidity

This has been more loosely observed in the commencement of this dissertation, and is now more accurately insisted on, not only to preserve consistency, but to develop any obscurity in which it might otherwise seem to be involved, and by some thought problematical.

 But

But in the reduction of alkohol, and spirituous liquors above proof, to what is called proof spirit, the commercial standard for sale, and for regulating the duties or excise payable on making and importing them, consisting of fifty-five parts of alkohol, and forty-five in the hundred of water, gives a proportionate augmentation of hydrogen, a comparative increase of oxygen, without any addition of carbon. This may be observed in all the intermediate changes, not only from alkohol to proof spirit, but also from proof, down to vinosity, and from that up to simple water. All of which may be noted by the hydrometer, and proved by analysis.

It is almost needless to say, that the carbon is larger in proportion, as the fluid contains most alkohol or spirit, and the hydrogen in proportion as it contains most water. The bare inspection of the table of positions, shew the fluctuation of the oxygen in the compound fluid.

The making of Bread is a species of fermentation more interesting than is generally imagined, the practice of which is much better understood than the theory. It is subject to many abuses that might be advantageously corrected, over and above which it is capable of improvement.

The extraordinary discovery I have made of a substitute for grain in the preparation of vinous fluids intended for beer, ale, &c. and for the extraction of ardent spirit, may be advantageously employed as a ferment in making of bread, to which it will give additional strength and quality without much increase of weight, a circumstance that may serve the public more than the baker, and highly interesting to private families, and all who bake their own bread; as this bread is light, pleasant to the palate, easy of digestion, and indeed wholesome and good in every respect; will go much farther, and by that means lessen the consumption of bread-corn.

Almost

Almost every one is acquainted with the difference there is between light well fermented bread, and that which is sodden, badly risen, and heavy, and the decided preference given to the former over the latter, as the most wholesome, palatable, and easy of digestion : and with the common observation that the best bread goes the farthest, which is the exact fact.

The magnitude, bulk, or size, being considerably increased, the expansion being in proportion to the fermentation or rising of the dough, which is generally somewhat increased in the baking.

The great escape of fixed air, or carbonic acid gas, in other vinous fermentations, is here pent up and confined by the viscous tenacity of the dough, which expands by the impressive impulse of the elastic gas expanding in all directions, augmenting the bulk and sponginess of the bread, rendering it large, light, and digestible. Thereby lessening the labour of the stomach.

There are but few people who have not experienced some inconvenience from eating bread hot from the oven, even from what is usually considered as good bread in this metropolis, an inconvenience that happens more frequently in the country, where still greater abuses are exercised than in town, and where the bread of the common-baker on an average is seldom so good. This inconvenience arises from the sudden distention of the stomach from the re-expansion of the hot bread perceivable almost as soon as it is swallowed, particularly if not sufficiently masticated. This inconvenience is not so common, when the bread has been baked one or two days, as it must be better masticated from its driness, and usually less of it consumed. The better bread has risen, and the more it is enlarged in bulk, provided it is well baked, the lighter and more spongy, the more pleasant, easy of digestion, and wholesome it will be, and the farther it will go, as the less of it suffices, are circumstances too obvious to further insist on.

All

All these desirable properties will be very much increased by the additions of our substitute for grain, being an increase of strength and quality, with a considerable augmentation of bulk, and some addition of weight, when used only as a ferment to supersede the use of yeast: when employed to augment the quantity, both with respect to measure and weight, as a substitute for flour, in the proportion of an eighth, sixth, or quarter-part, then a certain portion of leven, or other acid ferment abounding with oxygen may be necessary to assist its efficacy and dilute or disoxigenate any brownish tinge it might give when used in quantity, that otherwise might injure the fairness of the bread, a grievance that may be wholly done away by a small addition of such qualifying acid ferment: against the wholesomeness and palatableness of which no well-founded allegation can be brought.

These observations, it is hoped, will form a new *æra* in the doctrine of fermentation; they are more properly brought in here as the intelligent malt-distiller looks deeper than the common brewer into its operations, and understands the decomposition and attenuation of fermentable matter more clearly and minutely, from the nature of his process, and the richness of his worts, which are considerably increased in their specific gravity by the addition and grossness of the lob. The variety of circumstances that occur in the management of the materials that compose a back of distillers wash; with the prolongation of the operation, furnish opportunities for applying the improvements suggested, all of which cannot be attempted by the common brewer, and some of which are inadmissible in practice, from the nature of the excise laws, and unpopular prejudices: perhaps equally absurd, which time may evince, when truth and reason break through the trammels of ignorance and obstinacy.

How much more conducive to the *Health* of the *Public*, and the *Wealth* of the *Nation*, to admit the intelligent malt-distiller, and ingenious brewer, with the permission of the chancellor of the ex-

chequer

chequer and lords of the treasury, under the inspection of the board of excise, to make experiments with a view of making a cheaper and more wholesome beverage for the benefit of the community; and a cheaper and less pernicious spirit, that would afford a greater revenue to the crown, and a more encreasing profit to the maker. This would promote the progress of science and wealth of the nation. We should then export those articles to other nations from the superior quality of their preparation and cheapness, that at present help to make up the balance of trade against us.

A far more interesting motive for the consideration of the legislator, is the reduction of the price of *grain*, and giving the most necessary article of life, *bread*, at a lower price, to the labouring part of the community, by partially saving its expenditure in *beer*, and almost wholly in the making of *spirits*, without increasing the consumption of edible plants, fother, or any thing at present employed as the food of man or beast.

Stimulated by financial motives, perhaps as laudable as any I could have or advance, men of science and philosophical turn, have sought after a substitute for the grain employed in brewing by the distiller, brewer, vinegar-maker, &c. They attempted the application of sugar and straw to these purposes, but failed in their experiments to make porter of these materials; all the sugar importable, and all the straw procurable, were they within the compass of the application, would fall short of answering the purpose.

Other speculative and ingenious men have proposed potatoes, parsnips, carrots, and other edible plants, wanted more urgently for the food of man or beast than sugar; consequently not to be spared for those purposes.

The culture of these might be advantageously increased I allow, and

and their application set about; but they would soon be found inadequate to the end. It would be too long and laborious a task to enter into an explanation of this here. Reasons will obviously occur to the reader of their inadequacy, were it even practicable to procure them in sufficient quantity for these purposes, and as an addition to the food of men and cattle, one or other of which ends might bear the expence of their culture.

The liberal hand of nature furnishes an inexhaustable source of materials, that has never been applied to the food of men or cattle, nor fit in their present state to answer any such purpose. Yet capable of being fitted for the use of the distiller, brewer, vinegar-maker, &c. much below the price that grain has been brought to market, during the last century.

The preference I gave at the commencement of these papers to the opinion of those practical men to whom they are addressed, should not be understood to interfere with that truly philosophic scepticism, which is always attended by a free and active spirit of enquiry, and which at present seems to actuate the minds of men in literary pursuits. So far from that, it is with infinite satisfaction I observe, that men in general have learned to appeal to common sense and experience, and to countenance no man's doctrine any farther than it is supported by facts, sound reasoning, and practical proof.

That preference can be in nothing more strongly seen, than in the use I have freely made of the labours of those great experimental philosophers, *Priestly, Lavoiser, Kirwan, Crawford, Bergman, Morveau,* &c. whose names reflect dignity on human nature

The absurd debates and abstruse speculations of the schools are now no more, and researches into nature are become the business or amusement of the learned and ingenious.

While

While philosophers forbore to present any thing to the world, but complete systems of nature, the progress of useful knowledge was necessarily slow and uncertain; but few had courage to attempt so vast an enterprise, and fewer still were capable of forming an hypothesis adequate to explain all the operations of nature.

The infinite variety of natural objects, the stupendous coincidence and diversity by which all agree, and all differ, must convince us, that no vigour of judgment, no warmth of fancy, are equal to the tracing of every phenomena to its source, or first cause. Hence our regret, that those talents should have been lost to mankind by speculating on *universal* nature, which might have been employed to the utmost benefit on some particular branches of philosophy, or by applying them to practical use.

Whoever hopes to acquire an accurate knowledge of the operations of nature, must be contented to proceed by cautious and painful analysis; for, as well might we pretend to build without materials, as to form, without observation and experience, a regular system of natural science.

The department of experimental philosophy is the unfolding of these phenomena, the causes of which unassisted reason cannot discover, and whose connections it cannot trace, but by the number and accuracy of observations and relations, which natural objects have to each other. Caloric, or heat, is in the universe the chief cause and principle of activity; the agent by which nature carries on her operations; plants, animals, and the leading operations of natural phenomena, derive from that source their growth, vigour, and animation. Nature, equally simple and perfect in every energy, has endowed the animal body, and matter in an active state, with the power of generating its own heat; without this, the temperature of the atmosphere, in various climates, would have been destructive of life, and

man could have only been the inhabitant of those zones which are called temperate. But, blest with this self-animating principle, he securely traverses the terrestrial globe from pole to pole.

The improvements proposed in the annexed *utensils*, though of considerable importance to the brewers and distillers of these kingdoms, and to the planters of the West India Islands, and our dominions abroad, should not be permitted to encourage those who adopt them to be too sanguine in their expectations. Success can only be secured by application and attention, which the careless and inactive can no more hope to obtain in this, than they can expect to follow the brewing and distilling business, with advantage, without assiduity and attention.

On the other hand, the improvements so carefully delineated here, and minutely described, in more able hands may suggest new ideas, and be much further improved, and greater and more important advantages derived from them than I have (at present) pointed out.

On the whole it is most strenuously recommended to those who adopt all or any of these improvements, neither to be too much elated or depressed with the issue of their first trials, but undeviatingly to persevere with the usual industry and care bestowed on the rest of their business, and they will then find, that too much has not been said in favour of them, calculating on the aggregate of all the advantages derivable from the proposed improvements, which will ultimately lessen their cares, and increase their profits in brewing, distilling, &c. by more exactly taking the *heats*, drawing the *lengths*, cooling the *worts*, attemperating the *fermentation*, completing the *attenuation*, conducting the distilling and condensation, saving the subtile parts of the *spirit*, &c.

With some indolent men the use of the thermometer was at first

thought

thought too much trouble; and with others, equally reprehensible for want of genius, enterprise, and spirit, the application of the hydrometer for taking the strength of spirit, and particularly for ascertaining the specific gravity of worts, was thought equally useless and as little attended to, until men of talents set the example and brought them into use.

The application of the barometer and electrometer, which I recommend for foreseeing and providing against the changes of the atmosphere, in the conducting the process of fermentation, I am prepared to expect will have their opponents, and I must allow, may be better dispensed with than the two former, because their proposed application cannot yet be fully understood until brought into practice, when their use may be found, at least equally advantageous, as it then will be manifest, that they are part of the great whole that necessarily completes the management of this interesting process, beneficially assisted by the application of these instruments of science to practical use.

The number of cuts relative to cooling, attemperating, fermenting, cleansing, impregnating, &c. should not induce the brewer, distiller, &c. to apprehend there is any difficulty in their use, or that they will be incumbered with much additional machinery, or utensils, as these cuts, or plates, are only different views of the same utensils in the various uses to which they are applicable, and rendered familiar by introducing them together with those now in use. The plates describing the coppers, stills, condensers, &c. for saving time, fuel, and labour, are separate things, the delineation of which could not be advantageously dispensed with, but the formation and use of which are equally simple and effective.

Large breweries, malt distilleries, &c. being considerable undertakings, for the carrying on of which the capital is usually made up by a number of partners, several of whom not being professional men,

 have

have no knowledge of the business in which their money is embarked, and some of those men who are possessed of professional information, not being scientific, I shall be under the necessity of being more minute.

I mean not to interfere in the local customs, to which different houses may be attached, as there can be but very few such customs, that may preclude the adopting, more or less, of these improvements, which are applicable to almost any method of work; but, when they find that by these IMPROVEMENTS they are enabled to make a BETTER ARTICLE from the same materials, they may then avail themselves of them.

PREPARATION OF RUM IN THE WEST INDIES.

In the *Still-house*, as well as the *Boiling-house*, the greatest cleanliness is necessary; the vats, at the beginning of the crop, ought to be well washed out, both with warm and cold water, to divest them of any sour stuff which may have accumulated or adhered to their bottoms and sides since they were last in use; and if every vat, just before the first setting, or mixing the liquor, in it, were to be rinsed with a little rum, I can venture to say, from my own experience, the distiller would be amply repaid for this trifling expence and trouble.

In setting the first round of liquor, a greater proportion of *skimmings* from the sugar-pans must be used, than will afterwards be necessary, as the distiller has no good *lees*, and very little *molasses*, to add to the mass; and besides, the skimmings at this time are not so rich.

rich as they will be some time hence; that is, in March, April, and May, which are esteemed the best yielding months. I have found the following proportions to succeed well in the beginning: for every one hundred gallons your vat contains, put forty-five gallons of skimmings, and five gallons of *molasses*, to fifty gallons of water.

When you have got good *lees*, or *returns* as they are commonly called, mix equal quantities of *skimmings*, *lees*, and water, and for every one hundred gallons, add ten gallons of *molasses*.

When the mill is not going, and therefore you have no *skimmings*, mix equal parts of *lees* and water, and for every one hundred gallons add twenty gallons of *molasses*.

From liquor set in these proportions, the distiller may expect to obtain from *ten* to *fifteen* per cent. of Leeward Islands proof rum, and twice as much *low-wines*.—But the quantity of spirit will depend greatly on the quality of the ingredients, and in some measure on the weather; therefore an intelligent distiller will vary his proportions accordingly. In cool weather, or in moist situations, it is sometimes necessary to have small fires burning in the still-house, and when the fermentation is observed to be sluggish, a few gallons of warm water, or warm *skimmings*, should be added to forward its progress.

The vats are commonly covered with *mats*, which should be made closer or thicker according to the climate of the still-house. These mats are taken off once a day to examine the liquor, and stir in the froth or head. As soon as it is cool, that is when the fermentation ceases, which generally happens about the ninth or tenth day after mixing, the liquor should be put into the still. Particular attention should be paid to this, because the mass looses part of its spirit every hour it remains after this period, and in a few days would become sour, like vinegar.

The

The remainder of the process in distilling is very simple and easy. The worms must be kept in a cool state, by a constant stream of water running into the *tank**, or worm-tubs, while the rum is running. The fire under the stills ought to be regular and uniform; for otherwise the spirit will have an empyreumatical, or disagreeable burnt flavour. No kind of fuel answers so well as coals for this purpose, and it will be for the interest of the planter to import yearly a sufficient quantity for the stills, particularly on those estates where there is no wood.

THE DISTILLATION OF RUM, CONTINUED.

Rum differs from what we simply call sugar spirit, as it contains more of the natural flavour, or essential oil, of the sugar-cane; a great deal of raw juice, and even parts of the cane itself being often fermented in the liquor, or solution, of which the rum is prepared.

From hence it is generally thought, that rum derives its flavour from the cane itself. Some, indeed, are of opinion, that the unctuous or oily flavour of the rum proceeds from the large quantity of fat used in boiling the sugar. This fat, indeed, if coarse, will give a rancid flavour to the spirit in our distillations of the sugar liquor, or wash, from our refining sugar-houses at home; but this is nothing like the flavour of the rum.

Great

* *Tanks* may be defined to be water reservoirs; and, in this case, stone worm-tubs, made in a circular form, from eighteen inches to two feet thick; cemented together, and lined or plaistered with a peculiar kind of terras, made with lime, clay, and molasses, which holds water, and bears the weather well. They are commodiously supplied with water from any high ground, near which still-houses in Jamaica are built for that purpose: as are the boiling-houses, for water to turn the mills for expressing the cane-juice, and supplying the boiling-house.

Great quantities of rum are made at *Jamaica, Barbadoes, Antigua*, and other sugar islands. The method of making it is this:

When a sufficient stock of materials is got together, they add water to them, and ferment them in the common method, though the fermentation is always carried on very slowly at first; because at the beginning of the season for making rum in the islands, they want yeast, or some other ferment, to make it work; but after this, they, by degrees, procure a sufficient quantity of the ferment, which rises up as a head to the liquor in the operation; and thus they are able afterwards to ferment, and make their rum with a great deal of expedition, and in very large quantities.

When the wash is fully fermented, or to a due degree of acidity, the distillation is carried on in the common way, and the spirit is made up proof; though sometimes it is reduced to a much greater degree of strength, nearly approaching to that of alkohol, or spirit of wine; and it is then called double-distilled rum.

It would be easy to rectify the spirit, and bring it to a much greater degree of purity than we usually find it to be of, if it did not bring over in the distillation so large a quantity of the gross oil; which is often so disagreeable, that the rum must be suffered to lie by a long time to mellow before it can be used; whereas, if well rectified, its flavour would be much less, and consequently much more agreeable to the palate.

The best state to keep rum, both for exportation and other uses, is doubtless in that of alkohol, or rectified spirits. In this manner, it would be contained in half the bulk it usually is, and might be let down to the common proof strength with water, when necessary. For the common use of making punch, it would likewise serve much better in the state of alkohol, as the taste would be cleaner, and the

strength

strength might always be regulated to a much greater degree of exactness than in the ordinary way.

If the business of rectifying rum was more nicely managed, it seems a very practicable scheme to throw out so much of the oil, as to reduce it to the fine light state of a clear spirit, but lightly impregnated with the oil; in this state it would nearly resemble arrac, as is easily proved by mixing a very small quantity of it with a tasteless spirit; for it then bears a very near resemblance to arrac in flavour.

SUGAR SPIRIT.

We mean by a sugar-spirit, that extracted from the washings, skimmings, dross, and waste of the boiling-house.

These recrementitious, or drossy, parts of the sugar, are to be diluted with water, fermented in the same manner as molasses or wash, and then distilled in the common method. And if the operation be carefully performed, and the spirit well rectified, it may be mixed with foreign brandies, and even arrac in a large proportion, to great advantage; for this spirit will be found superior to that extracted from treacle, and consequently more proper for these uses.

In *Barbadoes* a very good spirit of this kind is prepared from the cane-juice, called Cane-spirit, resembling very pure rum.

OF RAISIN-SPIRITS.

By raisin-spirit, we understand that extracted from raisins, after a proper fermentation.

In order to extract this spirit, the raisins must be infused in a proper quantity of water, and fermented in the manner described in the chapter on fermentation. * When the fermentation is completed, the whole is to be thrown into the still, and spirit extracted by a strong fire.

The reason why we here direct a strong fire, is, because by that means a greater quantity of the essential oil will come over the helm with the spirit, which will render it much fitter for the distiller's purpose; for this spirit is generally used to mix with common malt goods: and it is surprising how far it will go in this respect, ten gallons of it being often sufficient to give a determining flavour, and agreeable vinosity, to a whole piece of malt spirits.

It is therefore well worth the distiller's while to endeavour at improving the common method of extracting spirits from raisins; and perhaps the following hint may merit attention:

When the fermentation is completed, and the still charged with fermented liquor, as before directed, let the whole be drawn off with as brisk a fire as possible; but, instead of the cask, or can, generally used by our *English* distillers for a receiver, let a large glass, called by chemists a separating-glass, be placed under the nose of the worm, and a common receiver applied to the spout of the separating-glass; by this means essential oil will swim upon the top of the spirit, or rather low wine, in the separating-glass, and may be easily preserved at the end of the operation.

The use of this limpid essential oil is well known to distillers; for in this resides the whole flavour, and consequently may be used to the

 greatest

* See made wines or sweets.

greatest advantage in giving that distinguishing taste, and true vinosity, to the common malt spirits.

After the oil is separated from the low wine, the liquor may be rectified in *balneum mariæ,* into a pure and almost tasteless spirit; and therefore well adapted to make the finest compound cordials, or to imitate, or mix with the finest *French* brandies, arracs, &c.

In the same manner a spirit may be obtained from cyder. But, as its particular flavour is not so desirable as that obtained from raisins, it should be distilled in a more gentle manner, and carefully rectified in the manner we shall shew in the chapter on rectification; by which means a very pure, and almost insipid spirit will be obtained, which may be used to very great advantage in imitating the best brandies of *France,* or in making the finest compound waters or cordials.

OF ARRAC.

What is properly meant by the term arrac, is a spirit extracted from the fermented juice of certain trees common in the *East Indies,* particularly those of the cocoa and palm-tree. The whole process of making arrac is performed in the following manner.

In order to procure the vegetable juice for this operation, the person provides himself with a sufficient number of small earthen pots, with bellies and necks, resembling our common glass bottles; a number of these he fastens to his girdle, or to a belt across his shoulders, and climbs up the tall trunk of the cocoa-tree; having reached the boughs of the tree, he cuts off, with a knife, certain small buds, or buttons, applying immediately to the wound one of his bottles, which he fastens with a string to the bough. In this manner he proceeds, till he has fixed his whole number of bottles, which serve as receivers to the juice

distilling

distilling from the wounds. This operation is generally performed in the evening, a greater quantity of juice flowing from the tree in the night than the day. The bottles are next morning taken off, and the liquor emptied into a proper vessel, where it spontaneously ferments. As soon as the fermentation is completed, the liquor is thrown into the still, and drawn down to a low wine; but so very poor and dilute, that they are obliged to rectify it in another still, to that weak kind of proof spirit we generally see it; for, though it appears bubble-proof, it rarely contains more than a sixth, and sometimes only an eighth, of alcohol; all the rest being no more than an acidulated water, which might be supplied from any common spring. Why arrac appears bubble-proof, when in reality so far below what we mean by proof, is not so great a mystery as at first sight it appears to be; for this kind of proof is entirely owing to a certain tenacity of parts of the liquor, or to the particular property of the oil incorporated in the spirit; as we shall abundantly shew in a subsequent chapter.

From this account of arrac, it should seem no very difficult matter to imitate it here. And, perhaps, the whole difficulty lies in procuring a pure and insipid spirit; for it is ridiculous to attempt it with our common malt spirit. With regard to the flavour of the arrac, it may be effectually imitated by some essential oils easily procurable.

Hence we see of what prodigious advantage a pure and insipid spirit would be of to distillers, and consequently the great encouragement there is to attempt the discovery. Perhaps a spirit of this kind may be extracted from sugar properly refined. The hint is worth prosecuting, and the writer of this, from repeated experiments, is abundantly convinced that the thing is practicable. Had he entirely succeeded, he would readily have communicated the whole for the benefit of his country; but is now obliged to defer, to some future opportunity, the result of his inquiries. In the mean time, he would

 recommend

recommend the prosecution of this hint to those distillers who endeavour to improve their art, and to advance it nearer to perfection.

Since arrac is a spirit extracted from the juice of the cocoa-tree, it may perhaps be worth enquiring how nearly it may be imitated by fermenting and distilling the juices of the birch and sycamore trees. We should by this means obtain an *English* arrac; and, perhaps, a spirit equal in flavour to that imported from *Batavia.*

When the cask, in which the arrac is imported, happens to be decayed, or the liquor touches any nails, or other iron, it dissolves part of it, and at the same time extracts the resinous parts of the oak, by which means the whole liquor in the cask acquires an inky colour. In order to whiten and clarify arrac, which has contracted this colour, a large quantity of new or skimmed milk must be put into the cask, and the whole beat together, as vintners do to whiten their brown wines; by this means the inky colour will be absorbed by the milk, and fall with it to the bottom, so that the greatest part of the arrac may be drawn off fine, and the remainder procured in the same condition by being filtrated through a conical flannel bag.

METHOD OF DISTILLING RUM IN THE ISLAND OF JAMAICA, ST. VINCENT'S, &c.

In the month of January they begin cutting down their sugar-canes, and such as are damaged, watry, or unripe, are expresed by themselves, as they produce too weak a juice for the preparation of sugar. They are employed for the making of rum; sometimes alone, when the crop turns out bad, but generally in conjunction with the skimmings of the sugar-pans, and the molasses that drain from the sugars, and a due proportion of *donder,* which is the spent wash.

N. B. The

N. B. The planters of St. Vincent's reckon, that this *donder* is not very good until it has passed through the still three times at least, and the oftner it has been distilled the better it is. *

The usual method is, when there is molasses enough to begin the distilling, the damaged and unripe canes are pressed at the mill, and added to the vats, previously prepared with molasses and water mixed in certain proportions; about which the different planters of the same island are not exactly agreed; some put six gallons of water to one of molasses, others five, and some only four gallons; and all distribute their skimmings of the sugar, but in different proportions likewise, from ten to twenty-five per cent. according as they have them in quantity. *N. B.* Skimmings are not so strong or rich by one-half as molasses; therefore, for every one hundred used, deduct one of molasses; they all being agreed, that the skimmings make the best rum; the molasses the third best; and the cane-juice the worst; that is, when each are used alone, or unmixed with each other; and all three together make the second-best rum. Cane-juice, from its qualities of heating and running into spontaneous fermentation, is exceedingly fit to commence work with, and season the vats, which remain useless from crop to crop; and they usually use raw sugar with the skimmings and cane-juice the first time, sugar being more prone to ferment than molasses.

The Skimmings too are much more prone to run into fermentation than the molasses or sugar; therefore, they are useful both as a flavouring and fermenting ingredient. The heat of the atmosphere in the West Indies, which is from sixty to eighty degrees of Farenheit's thermometer, and sometimes up to one hundred, greatly contributes to spontaneous fermentation, and also to expedite the process, which

* Each distillation concentrates the acid saline matter of the *donder*, and probably increases its activity.

which in these islands seldom exceeds six days, and often less. I have already observed, that they begin the work the first time with cane-juice, to which (in the island of Jamaica) they add a certain portion of *donder*, which is the spent wash of the last year's distillation, from which the spirits of the first extraction are drawn off; of this remaining *wash* there is enough reserved to fill up all the vats or backs of the still-house, which both keeps them tight, and serves the next year for mixing in certain portions, that is, from one-third to one-half the quantity of fluid used, instead of so much water, and is now a strong active acid with the water and molasses. This donder, or spent wash, answers both as a ferment and a cutter; for it cuts the head of the fermenting liquor, or wash, which would otherwise work in a frothy manner for a fortnight or three weeks, and finally exhaust itself in such a manner as to produce much less spirit, were none of the donder employed. In fact, it has the same effect which *jallap in powder*, employed with molasses, has in *Great Britain* and *Ireland*, where it is used exactly for the same purpose of cutting the frothy head, causing a quick intestine motion in the fermenting fluid, and throwing down the head: which is the constant practice in both these kingdoms at the latter end of the fermentation. This donder is in such estimation in Jamaica, that the true rum flavour of their spirit is solely attributed by these islanders to it. When they come to use it, they find it covered with a scum of tough mouldy skin some inches thick; at the bottom a gross acid sediment, the liquor between being of a fine Madeira colour, and extremely acid. The scum and sediment are carefully separated and flung away, and the clear liquor employed in each fermentation.

In the islands of St. Vincent and Grenada they use donder also, which they call lees and returns; but they use their donder fresh, and, when sour, fling it away; yet, what they use they mix with water, with which it soon turns sour, and then they add their skimmings,

mings, to which they attribute the rum flavour; and when the fermentation gathers strength, they add, lastly, the due quantity of molasses; and, if the fermentation goes on sluggishly, (in both the islands) they add more donder and some pressed canes, which are heated by lying in quantity together; these two, of which the last is the surest in effect, brings on a vigorous fermentation presently. In both islands they begin the fermentation with a weak solution of the materials, and do not add the whole until the fermentation has gathered strength. This may justly be called raising the backs with them.

Now, from comparing this method of fermenting and distilling molasses into rum, with the method of making sugar in the West Indies, and reflecting on how great a share *lime* in substance has in the business, and that the skimmings, in a great degree, consist of the native, or perhaps, tartarous acidity of the cane-juice, neutralized by the lime, we can account for the qualities of the skimmings, which act as flavouring and fermenting ingredients. Nothing can be more evident to a philosophical enquirer, who may not have an opportunity of making an analysis, than the nature of these skimmings, both from what we have said, and from the analogy of their effects. They consist of the native vegetable acid of the cane, combined into a *liquid tartar* by lime, which furnishes a kind of alkaline basis to the tartar, but which does not appear sour to the palate, though it contains much acid; first, from being perfectly neutral; and lastly, from being sheathed with the gross essential oil of the sugar; by which qualities it becomes a flavourer and fermenter, and yields abundance of spirit, when fermentation has brought about a resolution, and new combination of the tartar and essential oil. We may gather from the foregoing account, that the fermentation of wash for the production of rum in the West Indies, is principally the result of a due admixture of *sour* and *sweet*, assisted by the heat

heat of the atmosphere. This is corroborated by the necessity there is for restraining the cane-juice from the disposition it has to ferment, by neutralizing the acid with lime.

From the extreme proneness of the donder, or spent wash, to acidity, we must consider it also as a more dilute solution of tartar, combined with the mucilage, or carbon of the cane-juice, which, from the want of hydrogen, and from the unavoidable expedition of the fermentation in so heated an atmosphere, escapes being properly resolved and re-combined into spirit.

This comes in support, and indeed proves, my ideas, that molasses and tartar will make a stronger and more spirituous wine, brandy, and vinegar, than any materials hitherto employed for that purpose. I have already observed, that they use a large portion of raw-sugar at the commencement of a work, when they have no donder, the sugar being less viscous, and consequently more prone to ferment, than molasses. And, when the fermentation becomes active, make it up with molasses to the full degree of strength. There should be an hydrometer and thermometer; the former to ascertain the specific gravity of the wash, and the latter to regulate its temperature.

METHOD OF FERMENTING AND DISTILLING MOLASSES IN GREAT BRITAIN AND IRELAND.

They set the backs in the former by adding two gallons of water to one of molasses; in the latter, they add three of water to one gallon of molasses; to which, (in both places) they add about one gallon of barm, or yeast, to two hundred, and sometimes to three hundred,

hundred of molasses so mixed, these they blend with a large birch-broom uniformly together; this they call setting. This must be attended to once or twice a day, and the head stirred in, or more barm added occasionally, or the air partially excluded to keep it warm, if it works slow; and admitted fully, if it works fast.

In three days, or four at most, the backs must be *raised*, by adding (in Great Britain) two gallons of water more to each gallon of molasses *set*; and (in Ireland) the same; consequently they work their wash one-fifth stronger in Great Britain than in Ireland; and when they wish to evade the duty or excise, they work their wash still stronger; but this materially hurts the quality and quantity of the produce. In winter time, the water added to the backs should be heated to a degree below blood-warm, that the backs are raised with, which may be done by heating some water scalding hot, not boiling it, in one of the stills, and drawing as much in the filling-can as will heat the remainder of the cold water to the degree wanted. When the intended portion of water is added to each back, the same proportion of barm is to be added as at *setting*, and all well blended together with the broom; *this is termed raising*. The same, and rather more attention must be paid after setting, and barm added, if necessary. The third stage of the fermentation is *cutting*; which is performed four, five, or even six, days after raising, but is seldom deferred so long; 'tis done by adding about an ounce of good *jallap-root* in fine powder, to every eight or ten hundred weight of molasses, in summer, and about half as much more to the same quantities in winter, with the same proportion of barm, as at setting and raising; which must be all well blended together with the barm. *This is called cutting the backs*; which, indeed, it very effectually does, cutting down the head or crust of flowers or barm, which the intestine motion of the fermentation threw up, and communicating a very effectual and quick fermentessence through the whole fluid mass, very distinguishable at the top of the fluid to the sight, and also to the ear,

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the hissing noise of which can now be distinctly heard. As this tumultuous motion and hissing noise lessens, the operation draws towards a conclusion; and when they can be no longer distinguished, which is generally in three or four days after cutting, the fermentation is over, and the *fermented wash* is to be emptied into the still, and the backs set anew, as before directed. This fermented wash, distilled as long as a glass of it, thrown upon the still-head, will burn or take fire from a lighted paper or candle, is called low-wines, or spirits of the first extraction, and the operations singling, and what remains in the still, the *spent wash*, which is here thrown away. These low-wines are kept for three distillations, which quantity generally fills the still; which is called doubling, or spirits of the second extraction, and are drawn off as before directed. This spirit, lowered with water to the hydrometer standard, is called proof spirit.

After the setting of the backs, if an addition of the barm does not bring on a sensible fermentation through the whole, a five-gallon can of the warm spent wash, added to every two hundred gallons of the fermenting wash, will in general bring on the desired degree of fermentation; if not, about half the quantity of jallap usually used in cutting the backs must be added now, and the other half at cutting the backs. In winter, particularly in frosty weather, the part of the still-house, where the fermentation is going on, must be heated to the temperature of temperate on the thermometer, which will much facilitate the process. This may be done by the heat of the stills at work, in winter; and the excess of heat from the stills in summer may be counterbalanced by windows contrived to draw a current of air across the still-house.

COMPARISON.

The difference between the manner of conducting the fermentation in the West Indies, and in Great Britain and Ireland, seems to be owing

owing to the different temperature or heat of the atmosphere in these climates. In the West Indies, the greater degree of heat there appears propitious to fermentation, and precludes the necessity of gross ferments, such as barm and jallap, which probably contribute to render molasses spirit so much grosser and insipid than rum. The heat, so congenial to fermentation, there spontaneously produces it, without any other addition than the cane-juice at the commencement of the work, (a little raw sugar excepted) which juice, by the by, would run into fermentation so strongly, from its component qualities, sweet and sour, promoted by the heat of the climate, as to become putrid in twenty-four hours, if not immediately tempered by lime, as soon as expressed, which, combining with its acid, allays its heat and disposition to ferment; and the donder, or lees, as before observed, restores this disposition, by the addition of their acid to the sluggish sweet, and finishes the fermentation, which, in such a heated atmosphere, they are sufficiently fermentive to accomplish, from their acidity and tendency to reproduce fermentation, when combined with a sweet. The grossness and insipidity of molasses spirit proceeds, in some degree, from the cold, sluggish, protracted fermentation it undergoes with us, which, joined to the grossness and foreign flavour of the ferments, barm and jallap, renders it a spirit so different from rum, and so destitute of acid spirituous vinosity, when made in the best European method.

N. B. Dr. Franklin has observed, that the wash in a distiller's vat, when in the highest and most perfect degree of fermentation, is about the temperature of animal heat; that is, from ninety to ninety-six degrees of Farenheit's thermometer.

Whereas the superior heat of the West Indian atmosphere encreases the fluidity of the molasses, resolves their mucilaginous vinosity, attenuates their essential oil and mucilage, and excites a spontaneous fermentation, without the addition of gross ferments, that

communicate a foreign flavour; all which are much assisted by the saline tartarous acidity of the donder, which also promotes the acid spirituous vinosity of the wash, highly attenuates the mucilage and resin, and at the same time encreases the intestine motion, cuts down the viscous head, and thereby accelerates the fermentation, and exalts its essential oil to that peculiar flavour that distinguishes rum from molasses spirit, subtilises the tartar, and renders a part of the most subtile of the tartarous saline matter volatile in distillation.

Although the molasses that drops from the sugar-moulds at our refiners is so far different from the West India molasses, in containing much less of the native acid, * essential oil, mucilage, and resinous matter of the cane, yet it, no doubt, contains enough, with proper management, as before described, to produce a well-flavoured rum, provided they are worked in the requisite degree of heat, (as near as possible to that of the West Indies) and begun each time with sugar scums, or raw sugar of the grossest kind, blended with a due proportion of donder, or lees, and every addition of barm and jallap avoided; and, if the head should prove difficult to cut, let about three pounds and a quarter of tartar to each hundred of molasses be added at cutting time, instead of jallap, or even half that quantity of tartar to each hundred of molasses; which tartar should be previously dissolved in sixteen or twenty-four times its weight of warm water before it is added to the fermenting backs; and which addition of tartarous solution will not be wanting after the first turn distilled, as there will then be lees, or spent wash, to use in its stead: it should be carefully attended to when the solution of tartar is added, at any time, to molasses diluted with water, whether it cause an immediate effervescence. If it does, we may rely on it, that the solution of tartar

* If a solution of alum, or a dilute acid of vitriol, will ferment with this European molasses, then are we sure that it contains a tartar of sugar, consisting of this native acid and the most saline particles of lime united with it; and these additions, while they cause any fermentescence, may be added to set this fermentive acid at liberty.

tartar disengages the acid of sugar, which is most fit for the purpose, on every account.

N. B. Both the donder and solution of tartar must be allowed for as so much water, or the fermenting wash will be lowered in proportion; which would be an unneccssary impoverishment.

Some Hints on the Method of fermenting Molasses for Brandy and Vinegar, which expedites the Process, and abundantly improves the Quality.

Molasses, from its viscous tenacity and mucilaginous qualities, requires a greater degree of heat in the surrounding atmosphere than Must, which requires no greater than from fifteen to twenty-five degrees of Raumer's thermometer, from its superior tendency to ferment, consequently no addition is necessary to induce that disposition in Must, as it contains all the requisites enumerated.

The additions we use, barm and jallap, producc the effect, but ruin the flavour, which proceeds conjunctively from these heterogeneous additions and the grossness of the wash, which is too strong, and fermented in so chilling an atmosphere for a perfect resolution of its component parts, notwithstanding the length of a long protracted fermentation of twelve or fourteen days; the produce of which is at best that insipid firey spirit, called molasses spirit, so disgustful to every palate of any delicacy.

To remedy this, and produce a fine rich, vinous, oily, fluid, or spirit, that, with a little age and proper management, will smell and taste like genuine wine or vinegar, and, if distilled, produce a well-flavoured brandy, the fermentation ought to be begun and carried on in a heat not less than fifty-five, and from that to sixty-five or seventy

seventy degrees of Farenheit's thermometer, according as it is intended for wine, brandy, or vinegar. The quantity of water to molasses may be encreased one-third, that is, instead of forty gallons of water to one hundred weight of molasses, there may be sixty gallons of water, or thereabouts, or it may not be encreased; this at the pleasure of the operator.

Lees of wine, but particularly tartar, from their saline quality, attenuate and divide the tough mucilaginous quality of the molasses, a property common to all saline bodies; for which reason, to every one hundred weight of molasses, there should be one hundred of dry lees of Rhenish wine added, or such as hatters employ; or two hundred and an half of wet lees of Rhenish wine; one half of which must be added at setting, and the other half at raising the backs; or, in lieu thereof, seven pounds of powdered Rhenish tartar to each hundred weight of molasses; one half at setting, and the other half at raising the backs, dissolved in sixteen or twenty-four times its weight of water; which water must be part of the portion of the water of the wash, that is, part of the water employed in making, or mixing, the fermenting wash; or, rather, three pounds at setting, two pounds at raising, and two pounds at cutting. But the lees of wine are always to be preferred, and the wet lees to the dry; a much greater quantity of which may be used, and also of tartar, when it is found consistent with cheapness; the quantities set down here being the least that can possibly be used to produce the effect with any degree of certainty. Half this quantity of lees and of tartar are better than either separate. The water with which the backs are set, should be heated in the boiler to ninety-eight degrees of blood-warm, as the coolness of the vessels, molasses, and wine-lees, will bring it down to sixty degrees at least on mixing. The water added on raising the backs should be attemperated to the exact degree of heat in each back to which it is added. Which must be done by placing a thermometer into each back, and cooling the water, before added, to the

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exact degree of heat by the same thermometer. These thermometers are such as are made for brewers. By pursuing these means, you may have a rich genuine brandy, observing to colour with burnt-sugar, oak-chips, terra japonica, &c. See further under the heads "*Made Wines, and Preparation of Vinegar.*"

DISQUISITION: OR, ENQUIRIES INTO THE NATURE AND QUALITIES OF SPIRITUOUS LIQUORS.

* The custom of drinking spirituous liquors is now so prevalent, that the consideration of their effects on health, in order to a choice and proper use of them, is become a matter of very great consequence.—The difficulty of the subject, as it requires a peculiar knowledge in chemistry, phisiology, and parthognomonic observation, has, nevertheless, discouraged attemps to give the public such a system of the principles and relative facts, as might communicate just and demonstrative notions of it.—From this want of sufficient lights for understanding the nature of spirituous liquors, and judging of the comparative goodness of the several kinds, many errors have taken rise with respect to them: some of which have, by design or accident, been so widely propagated, as to be detrimental to a great number of people, by leading them to prefer the less wholesome, or bad kinds of these liquors, to the good.

Among these errors respecting the choice of spirituous liquors, there is one of very momentous consequence, which has gained much ground of late; and, if not checked, will, in all probability, become still more general. It is, *the believing* Brandy *to be a more wholesome distilled*

* It is twenty-six years since I had a principal share in drawing up this Disquisition, which induces me to give it a place here.

distilled spirit than Rum.—This false notion has got possession of the minds of many people: though it is not a clear point, whether it owed its origin to a real mistake, or was artfully broached to promote the selfish and sinister views of some designing persons in trade. For it has, indeed, been asserted lately in the public papers, that the French, who are much interested in establishing a preference of brandy to rum with us, have engaged some practitioners in medicine to lend their venal aid, in giving credit to the unjust pretension of a reason for such preference.—But, from whatever source this error did originally flow, the extensiveness and force of its prejudicial effects are the same: as it has, by some means or other, been so diffused, as to influence great numbers of persons, both in town and country.

There is not the least foundation, nevertheless, for the belief, that brandy is superior to rum in any of their qualities which can effect health: on the contrary, it is evident, from the clearest proofs which subjects of this nature can admit of, that the drinking rum in moderation is more salutary, and in excess much less hurtful, than the drinking brandy.—But, however ill-founded the notion of the superiority of brandy to rum may be, it has produced very detrimental consequences to the public, in several different ways. By causing a much more general use of brandy than before, it occasions a greater number to run the risk of impairing their health; as they who drink it are not only liable to suffer more in case of excess, even from the brandy than from rum, but to be hurt, also, by moderate quantities, in consequence of the present almost general adulterated state of it. Besides this, by lessening the demand for rum, it has done mischief to our West-Indian colonies; and been injurious to our balance of trade, and political interest, by augmenting the consumption of a foreign commodity, purchased for money of our rivals, to the exclusion of one produced in our own dominions, and supplied in exchange for our manufactures and domestic products.

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It is, therefore, much to be regretted, that a notion, which, if duly examined, will be found to want the support, even of any specious or plausible argument, should be passively suffered to be the cause of so many evils: as it seems to have maintained its ground, merely from the neglect of its being properly opposed and confuted. For it may be concluded, with great reason, that, if the public were assisted with just lights for examining fairly the comparative wholesomeness of rum and brandy, the truth of the superiority of rum would be so glaring, as could scarcely fail to banish the prejudice now subsisting, from the minds of those, who would take the least trouble in considering the subject: which, as it respects the health of all who drink brandy habitually, or are disposed to do so, is a matter of very important concern to them.—The extirpating the error furnishes, therefore, one strong inducement, among others, to the inquiry into the principles on which the salubrious and noxious qualities of spirituous liquors depend; and an examination, by the application of those principles, into the merits of the particular kinds.

The explaining the nature and operation of spirituous liquors, with relation to their effects on the human body, is not, moreover, attended with insurmountable difficulties.—From experiments, shewing the particular action of distilled spirits on animal substances;—from appearances, in the dissected bodies of persons who have died by the immoderate use of such spirits, taken in a noxious state; and from observations on the nature of the diseases and symptoms, by which these persons were brought to their end; we may, with certainty, collect what the particular operation and effect of those spirits are, in destroying the health of those who drink them in excess. And from the chemical examination and analysis of the several kinds of such spirits, we are enabled to judge, why, and how, they vary in their effects from each other. On these principles, it is not difficult to point out, in a satisfactory way, to intelligent and attentive persons, even though not at all studied in medicine and chemistry, the nature

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and effects of distilled spirits; as far as respects their wholesomeness, and the difference, in that point, of the various kinds from each other.

Premising these circumstances, it must appear very conducive to the public good, that such an explanation, and just view of the relative facts and principles, should be given, as would elucidate the truth respecting the salubrious or pernicious qualites of spirituous liquors, of their several kinds; and prevent the future, as well as remove the present impositions, in a matter pregnant with so much harm both to particulars and the community.—I have thence, on the total neglect of such an attempt by others, been induced to take this task upon myself: and I hope to offer such valid reasons for what I advance, as may afford conviction to every candid reader, who will bestow a moderate attention on them.

I mean, however, to confine my disquisition to the simple kinds of spirituous liquors, or the counterfeit substitutions for them; and not to extend it to the compound cordials, which are extremely various, and possess additional qualites to those of the simple spirits, according to the different ingredients in the several compositions of them. Such cordials, though they commonly pass under the denomination of spirituous liquors, and particularly one composition of this kind, called gin, which is very much drank among the lower people, are yet not to be classed with the simple spirituous liquors, in an examination into their general nature or distinct properties. The qualities of the various ingredients added to the spirit in such compositions, necessarily vary their effects on those who drink them; and each different kind requires, therefore, a particular consideration with respect to such qualities, that would be entirely foreign to the subject in view here; which is solely the properties of that spirit obtained by distillation from fermented liquors.

I shall,

I shall, therefore, in the following pages, first shew what the qualities are, by which spirituous liquors, improperly taken, do mischief to the human constitution.—I shall next demonstrate, that these qualities subsist in a higher degree in some kinds of spirituous liquors, now in use, than others:—and I shall lastly distinguish what these kinds are, and in what particular their depravity lies.

The disquisition of these several points leads of course, in some degree, to a scientific research into the subject; but I shall, in my conduct of it, avoid, as much as possible, all abstrusity; and accommodate both the language and matter to the comprehension of every liberal reader. To render the perusal less tedious to such as may not be disposed to enter into the minuter consideration of the more abstracted points, I have thrown the greatest part of the detailed explanation of principles and facts into notes; the reading of which may be omitted at pleasure, without occasioning any breach of connection in the body of the work.

In the prosecution of the design of enquiring into the absolute and comparative wholesomeness of the various kinds of spirituous liquors, by an investigation of their several qualities, and of those of the elements or ingredients that compose them, I shall, for the greater perspicuity, advance the following general propositions; each of which I shall afterwards endeavour to explain more minutely; and demonstrate by conclusions from incontestible doctrines, or deductions from well-established facts.

PROPOSITION I.

That distilled spirits, when rendered *pure and free from every other substance*, except that proportion of phlegm, or water, which can never be separated from them, are absolutely *alike* in their *qualities*;

 and

and *of the same identical nature,* from whatever kind of fermented liquor they may have been originally obtained.

II.

That distilled spirit, when in a *pure* state, and *separated from all other bodies,* except some phlegm, has a violent astringent action on the solid parts of animals, a coagulative effect on the fluids, and a power of diminishing the irritability and sensibility of the nerves; which qualities render it injurious to the health when drank in great quantities, or frequently with continuance.

III.

That spirits, when *originally distilled* from the various fermented liquors which afford them, *rise combined, or united, with volatile oils and acids, that correct and dulcify* them; * counteracting their noxious power, and rendering them not only less hurtful than when in a pure state;

* It has been long known in chemistry, that if rectified spirits be mixed with any strong acid, they will combine together or unite; and, being distilled, will come over in a combined state, where the acid will appear to be sweetened, and the spirit to have lost its astringent and firey taste.—This method of forming a compound of ardent spirit, and the acids, termed mineral acids, viz. the vitriolic, nitrous, and marine acid; (or, in medicinal language, oil or spirit of vitriol, spirit of nitre, and spirit of salt) was introduced into pharmacy, under the name of *dulcification* of the respective acids. But, as the ardent spirit is sweetened as well as the acid, and rendered mild in its flavour and qualities so long as its union with the acids continues, the dulcification is mutual; and the ACID may, with equal propriety, be said, also, to be DULCIFIED. I have, therefore, adopted the expression here in that sense: and, as I shall have frequent occasion to mention it hereafter, I shall call the change made in ardent spirit, by its union with any acid, the DULCIFYING it.—From this principle, as we shall see below, results a considerable part of the difference of distilled spirits from each other: and it is wholly through the application of it by art, that counterfeit brandy is made from malt-spirits only.

state; but, with regard to such as are most corrected, even salubrious, or wholesome, if used properly with moderation.

IV.

That, in *genuine* BRANDY, the spirit is *dulcified*, by combining, or uniting, with the native acid of the grape, and the acetous acid generated in the fermentation; which considerably checks the violence of the astringency and other unwholesome qualities, that the spirit would have if it were *pure*.

V.

That in RUM, the spirit is not only *dulcified* by the *acid* generated in the fermentation; but its noxious qualities corrected and repressed in a much more effectual manner, by the *volatile oil*, which rises with it in the distillation, and sheathes its pungency, so as to counteract, in a much higher degree, the offending qualities, than can be possibly effected through the dulcification of such spirit by acid, as in the case of brandy.

VI.

That the *Brandy now* generally brought to us from France, sophisticated by the addition of other spirits, or counterfeit brandy, *has similar qualities to pure ardent spirit*; and, therefore, is noxious to the health of those who drink it freely.

VII.

That, consequently, *the most genuine brandy is less wholesome than rum;* and the *counterfeit*, or *sophisticated*, *kinds of it very detrimental* to those who use them in considerable quantities.

The

The FIRST proposition, *that all distilled spirits are alike when pure,* is so generally admitted, as leaves no occasion to dwell long on it here. It is sufficient to observe, that the kind of fluid obtained by distillation from fermented parts of vegetables, and distinguished by the name of *ardent spirit*, and *vinous spirit;* or, in common language, *distilled spirits*, and *spirituous liquors*; is always generated by the same process in nature, called *vinous fermentation;* and produced from the same kind of substance, called the *saccharine juice of vegetables:* which saccharine juice, when rendered pure, is found to be the same in all the vegetables, or parts of vegetables, that afford it. The ardent spirit, however, when formed in the fermentation of the several various kinds of vegetable matter, is always combined, or united, * with other substances, principally volatile oils and acids, that are generated in the fermentation, or subsist natively in the subject vegetable matter; and the spirit rising in distillation, thus combined with them, has different properties, at least with respect to the degree, from those which it possesses when in a pure state.—But these substances, with which the spirit is originally so combined, may be separated by rectification, that is, repeated distillation, simply, or aided by other means, in such manner as to render it pure, except with regard to some quantity of phlegm, which will always remain mixed with it.—When thus perfectly rectified, or, in other words, brought to a pure state, the spirit, whatever kind of fermented liquor it might be originally obtained from, will, in any method of trial, be always found

* By the word *combined,* as here used, is meant, that union of two bodies with each other, on their being mixed together, in which some of the properties they had, while separate, are diminished, changed, or lost; and a new compound substance produced different from either of its two constituents.—In this particular, *combination* differs from meer mixture; by which two bodies may be conjoined in one mass, and yet not act on each other, so as to make any alteration in the properties of either.

found to have the same * properties and effects; allowing for the strength, that is, the proportion of real spirit to the phlegm, from some quantity of which it can never be freed.

The SECOND proposition, that *distilled spirit in a pure state has a violent astringent action on the solid parts of animals; a coagulating effect on the fluids; and the power of diminishing the irritability and sensibility of the nerves;* will be allowed to be equally true with the first, by those who are well acquainted with the subject.—These astringent and coagulating qualities of pure spirit, operate in a certain proportion and manner on the living human body, when such spirit is drank. Whence, by the constant improper use of it, not only the health is impaired, but frequently the animal economy is so much disordered, that even life itself is at length destroyed.—In persons who continue to drink distilled spirits in this noxious state till they receive injury from it, we see gradually come on a tabidness, or wasting, of the extremities, the skin of which seems shrivelled and dry. This tabidness is accompanied with a nervous weakness, or tendency to palsy, as appears by the shaking and debility of the parts.—It is obvious, that these effects are caused by the constriction and corrugation of the fibres, the coagulation of the lymphous humour, and the general diminution of power in the nervous system; the fluids ceasing to be able to pervade the vessels, as well from their contraced and indurated

* The sameness in ardent spirit, from whatever fermented liquor originally distilled, when highly rectified, and rendered pure, is known practically, as well as speculatively. Formerly, when brandy was the only distilled spirit in common use, the rectified spirit employed in medicines, and various arts and trades, was solely obtained from thence; and vended under the name of spirit of wine: as, indeed, it actually was spirit extracted from wine. But, on the discovery of the methods of procuring a distilled spirit much cheaper from malt, the low price of it occasioned that spirit to be substituted for brandy, to procure a rectified spirit: which was found to be so much the same with what was afforded by brandy, that it took its place and name; and was used both for medicinal and other purposes, under the name of spirit of wine; with which it has a real, as well as apparent sameness of nature.

indurated state, as from their own want of due propulsive force.—This change is so great in the exterior parts, as to be apparent in the very visage of those so affected, particularly in younger women, who have been very intemperate in the use of bad spirits; for the form of the face is altered in so peculiar a manner, that the cause of it is distinguished by a common eye, without the least reflection.—In the more advanced stages of the distemper, caused by the long immoderate use of noxious spirits, the appetite is lost, the digestion extremely disordered, and the secretions almost wholly suppressed. It is remarkable, also, that the coagulating power of ardent spirit on the animal juices, checks the natural ferments, on which both nutrition and secretion depend, in such a manner, that the spirit itself serves in the place of aliment, and supports weak life with the aid of very little food of other kind.—At length, however, the effects of this perversion of the animal economy prevail over the efforts of nature, and the wasting and weakness increase, till life is extinguished, from the extreme debility with which the vital functions are performed.—This is the manner in which noxious spirits destroy, when no particular chronical disease is brought on in the progress of their operation. But more frequently the intestines are so much affected, as to induce fatal disorders in the earlier stages of the diseased state, arising from this cause. The liver, in such cases, is, for the most part, rendered schirrous, and a dropsy ensues, which proves, in a short time, a mortal symptom.—The astringent and coagulating effects of the ardent spirits are very evident, on examining, by dissection, the bodies of persons who have died in this condition. The whole liver is often found converted to a *schirrous* of peculiar hardness, and made wholly incapable of its office of secreting bile. The mesentery is sometimes enlarged to an extraordinary degree; and its minute glands amazingly inflated and tumefied, so as somewhat to resemble bunches of decayed grapes, of a brownish livid colour.—Every disease, or symptom, indeed, occasioned by the use of spirituous liquors, may, from its very appearance, be justly ascribed to their astringency of the fibres, coagulation

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gulation of the juices. and injurious action on the nerves; * and serves to evince the noxious effects of distilled spirit to be owing to these qualities.—That such spirit possesses them in proportion as they approach to a pure state, that is, when not duly corrected or dulcified by an union with volatile oils, or acids, has been before sufficiently proved.

The THIRD proposition, that *spirits, when originally distilled from the various fermented liquors which afford them, rise combined, or united, with volatile oils and acids, that correct and dulcify them,* diminishing their noxious power, is easily demonstrated, both from experiment and observation. That there is a difference between spirit rendered pure by re-distillation, and those kinds that are in the state

* This action of ardent spirit on the nerves is evident in the case of those, who are killed by drinking an excessive quantity of it at one time: of which, during the period that Gin was so generally drunk amongst the lower sort of people, frequent instances happened. There are two ways by which the spirit becomes fatal to such as die under these circumstances: but both have their foundation in the same cause, acting more or less violently. Some of the persons, who owe their death to this excess, are, after drinking a certain quantity of spirituous liquor, seized with strong convulsions, and expire in a very short time. In this case, the action of the spirit on the nervous system is so great, that it entirely destroys their irritability; and, consequently, puts a full stop to the performance of their office in the vital œconomy. Others are taken with a *stupor*, or total insensibility; but do not go off under several hours; during which the vital action seems to cease gradually. In this case, the irritability is not wholly suppressed on a sudden, as in the first, but by a slower, and less violent effect. The ardent spirit in these instances acts on the nerves distributed on the surface of the intestines; and, being diluted by the secretion of lymphous fluid continually made there, a considerable quantity is required to produce this effect. But it is said to have appeared from experiment, that, by an immediate application of a small quantity of alcohol, or highly rectified spirit of wine, to the extremity of a divided nerve of a beast, convulsions and death will instantly follow. I have not seen the fact myself: but it is related on good authority. The very great astringent power of pure ardent spirit on the vessels of living animals, which must be ascribed, in a great degree, to their action on the nerves, is obvious, in its styptic effect, when applied to small divided blood vessels, where it instantly stops the effusion of blood.

state in which they rise on their first distillation, is evident from the various peculiar flavours and scents, by which rum, brandy, molasses, and malt-spirit, are most palpably distinguished, as well from such pure spirit as from each other; as all such peculiar flavours and scents are lost, when the respective spirits have been sufficiently rectified by re-distillation; which deprives them of those other substances they were combined with when they were distilled from the fermented liquors that afford them. That such spirits as have not been re-distilled have much less astringent and coagulative power than those which have been rectified and rendered purer, may be easily perceived by trial of their action on animal substances steeped in them; and their styptic effect on the divided blood vessels of living animals. The same difference, with regard to the degree of these qualities, is obvious, as to spirits distilled from different fermented matters, and not rectified; for some of them are much milder, and recede more from the noxious state of the purer ardent spirit than others. The difference from each other will, of course, be in proportion to the quantity and kind of substances with which they are combined, or united, in the fermentation or distillation, and consequently corrected, or dulcified, when they first come over.

The substance which, by uniting with purer spirits, counteracts their noxious qualities, are, as was before specified, *volatile oils* generated in the fermentation or distillation; and *acids*, either such as were native in the particular vegetable matter which was the subject of the fermentation, or such as are generated in the fermentation.* These corrective

* The acetous fermentation, or, in other words, the kind of fermentation which generates vinegar, always goes on, in some small degree, along with the vinous fermentation, or that which generates the ardent spirit, and of course produces some proportion of acetous acid along with the spirit. This is evident in the distillation of malt-spirits, where an acid is found to be left behind, which can have no other origin than the acetous ferment, there being no native acid in the malt, which is the subject of the fermentation. A part

corrective substances are in part combined with the spirit before the distillation, and rise united with it, and in part uncombined with it before the distillation; but, rising with it then, unite themselves gradually with it afterwards. It is from such union of the spirit with the corrective substances as takes place after the distillation, that spirituous liquors are so much improved by time. On keeping, especially in the cask, * where there is a large quantity together, they become

A part of this acid combines, or unites, with the spirit during the fermentation; the other part remains mixed, but not combined, or united, with it; and such of it as is more volatile, rises with the spirit in the distillation, while the more fixed is left behind in the still. As a proof of this, the same is found to happen, if vinegar be added to pure or rectified spirit, and they be distilled together. All spirits, from whatever kind of fermented liquor obtained, are, therefore, milder and less astringent as they rise in the first distillation, than when in a pure and rectified state; being thus dulcified by their union with a proportion of the acetous acid, as well as some proportion of volatile oil, produced in the fermentation.

* The fact, that spirituous liquors improve much more with time in the cask than in the bottle, is well known from observation; but the reason of that difference is not hitherto demonstratively ascertained. It is commonly ascribed to the escape of a fiery volatile part, which is supposed to find its way out of the cask more easily than out of the bottle. But the existence of such a fiery volatile part is not in the least proved by any experiment or known fact; and the principle we have established, of the union of the corrective substances with the spirit, must be allowed to be the real cause of the improvement in question. It seems, therefore, most feasible to place the reason of this difference in the degree of improvement, betwixt rum kept in the cask and that kept in bottles, in the following circumstance: The combination of two different kinds of bodies interspersed in any fluid is attended, in the act, with an intestine agitation of the parts of such fluid, from the combining particles operating on each other by their specific attractive powers, which draw them with celerity to a close union, when they come within a certain distance of each other; and we distinguish this state of a fluid, when sensible by its effects, by the name of *fermentation*. The intestine action is, in all such cases, necessarily greater, when it happens in large quantities of the fluid, than in small; as the motion of every part has a reciprocal effect on all the others; and the particles are consequently, by their being more put in motion, more speedily brought within the sphere of each others attraction.

become gradually milder, and lose that astringency, which manifested itself before this change in a seemingly fiery sensation in the mouth and throat of those who drank the spirit.

In the kind of spirits where acid abounds, they gain by time, in consequence of that dulcification by it whieh succeeds the distillation, a grateful flavour and odour; and, in those where volatile oil abounds, their seeming rankness of smell and taste gradually goes off, or sometimes is converted, by degrees, into a species of perfumed odour.— The wholesomeness of the distilled spirit is, also, in proportion improved, through the union of the spirit with the corrective substances, which time produces; as it causes a privation of the violence of those qualities above explained, which render the spirit noxious. On these principles depend not only the difference of spirits, undeprived of those substances whieh rise with them in the first distillation, from those which are rendered pure by subsequent rectification, but likewise their superiority over each other. As, for instance, in malt-spirits, where there is no aeid to dulcify them, but such as is generated in the fermentation; nor any volatile oil to correct them, but such as is produced in the distillation, the noxious qualities are much less counteracted than in rum or brandy. The same holds good of molasses spirit. For though, from the kind of materials whence it is obtained, it seems to have a considerable affinity with rum; yet, from the eircumstances of the fermentation, as it is effected in this climate, and from the manner of distillation practised here, it is so defective in the volatile oil, which is the great corrective, and gives the charac-teristic

We see this in the fact itself; as excessive ferments arise in large masses of some kinds of matter, that are not sensible in the least in smaller masses of the same. In the cask, therefore, the intestine motion produced in the rum, from the combining action of the corrective substances and the spirit, being much greater than in the bottle, the particles of them are in proportion brought sooner within the sphere of their mutual attraction; and the change in the rum, owing to their union, consequently more quickly completed.

teristic to rum, that it is most palpably different from it in taste and flavour, as well as in the salubrious qualities.

In the most perfect of distilled spirits, this melioration of them, by their union with the corrective substances that rise with them, so diminishes the force of those qualities which make the ardent spirit noxious when pure, and reduces it to a mild and gentle state, that, taken in moderation, they are not only safe and wholesome, but even, in some cases, salutary and medicinal. Their astringency, when duly restrained, renders them invigorating and cordial; and their power of checking the animal ferments, renders them antiseptic, that is, opponent to putrid disposition. Hence, in very cold countries, by their cordial effect in supporting the *vis vitæ*, and by their lessening the sensibility and irritability, they enable the tenderer races of mankind to bear that degree of cold, they could not otherwise endure at all, or not without mischievous consequences. In very hot countries they prevent, by the same astringency, that extreme relaxation, which is generally so incommodious and debilitating; and by their antiseptic power, that tendency to a putrid habit, which induces the most dangerous and troublesome diseases. Indeed, wherever a putrid disposition, and the consequent relaxation and weakness, are attendant on any febrile or other diseases, spirituous liquors are, on the same principles, the most efficatious remedy. In temperate climates, the use of them is in general an innocent refreshment and regale, when confined within the bounds of moderation and temperance. Particularly those kinds, in which the properties of the pure ardent spirit are most corrected, in the manner we have above explained.

The Fourth proposition, that, *in genuine brandy the spirit is dulcified, by being combined or united with acids, which considerably check the violence of the noxious qualities*, admits of easy proof. It is evident, from the difference of their flavour and smell, that the qualities of brandy vary from those of pure or rectified spirit; and, from the former's

former's not exciting the fiery sensation in the mouth and throat, which is caused by the latter, it is apparent, that the astringency in brandy is much less than that of pure spirit. The same is confirmed by trial, on steeping animal substances in each of these kinds of spirit.

That this difference of brandy from pure spirit is owing to dulcification by acids, is deducible, also, from its taste and scent: the same which may be given to pure spirit by artificial dulcification, by means of some kinds of acid. But the presence of acid in brandy, and its effects on the spirit, are more certainly demonstrated by re-distillation. On examination, after the spirit is risen, acid will be found in the residuum or remains; and the spirit itself will have acquired the qualities proper to it in its pure state, in proportion as the acid has been thus separated from it.

Genuine brandy of the best kind is distilled from wine, obtained from the juice of the grape. An inferior kind, also, is obtained from the fermenting a weaker must, procured by adding water to the marc, or solid part of the grapes remaining after the juice, or must, has been pressed out. In the fermenting this weaker must, gained from the marc, it is practised to add other fermentable matters to increase the quantity of spirit: and these, containing less of the corrective substances than the juice of the grape, the brandy thus made is consequently inferior to that distilled from wine.

In the wine of the grape, whence the good brandy is obtained, there is a large proportion of native acid: which, together with the acetous acid generated in the fermentation, as mentioned in the comment on *proposition the third*, unites with the spirit, and dulcifies it to a considerable degree. In many cases, the stone of the grape is broken in the pressing, and yields a small proportion of bitterish oil, which combines with the spirit, rises with it in the distillation, and

gives the brandy a nut-like flavour, that is esteemed one of the criterions of its being genuine and good. The union of the vegetable acids with the spirit, in this natural way, is so strong, as has been before mentioned, that the compound bears the addition of water in any quantity, without causing a separation of the two constituents: which is a very material property with respect to the wholesomeness of the spirit. For, in the artificial dulcification, which we shall have occasion to explain more particularly below, of pure spirit by mineral acids, as practised for counterfeit brandy, it is quite otherwise: and a separation always follows, on diluting with water, that entirely destroys the corrective action of the acids on the spirit.

Genuine brandy, being thus dulcified by vegetable acid, is considerably less astringent and coagulative than pure ardent spirit, and may be reckoned the most wholesome of the spirituous liquors in use with us, except rum and arrac, in which the spirit being more effectually corrected by an union with volatile oils, they are consequently more salubrious.

What has been here advanced, as to the nature and qualities of brandy, must, however, be understood to hold good only of such as are genuine; but the greatest part of what is drunk with us, at present, is sophisticate, not excepting even that brought over from France. This will appear an uncontrovertible matter of fact, when we consider, that the quantity of distilled spirits now consumed in Britain, under the name of French brandy, is far greater than the whole amount produced in France, of such as is real and genuine; and it is well known, that a large proportion of the brandy France affords, is not brought to us, but used there, or in many other places whither it is sent to make up their wines for exportation. If further confirmation of this assertion could be wanting, it might be proper to mention, that great quantities of malt-spirits and counterfeit brandy are sent from hence to certain free ports, in order to sophisticate the brandy

brandy made for importation to us. So that we are not to reckon on finding the qualities above ascribed to brandy, in that which we are able now to purchase here; but must judge of it by the properties of the sophisticate and counterfeit. How noxious these properties are, and what the preparation of such brandy is, we shall explain below, in our comment on proposition the seventh.

The FIFTH *proposition*, that, *in* rum, *the spirit is not only dulcified by an union with the acid generated in the fermentation, instanced by the addition of the donder, as may be seen under Rum, but corrected more effectually by volatile oil generated both in the fermentation and distillation,* will be found verified by the following proof. The fact itself is apparent, even to the senses, from the taste and smell of rum; and may, otherwise, be easily ascertained by the examination of the residuum, or remains, left on distillations repeated till the *spirit* be pure. The saccharine matter fermented, in order to the making rum, produces in hot climates a copious quantity of volatile oil, which unites with the spirit during the fermentation. Part of this oil combines then with the spirit; and comes over in the distillation united with it: and the other part rises uncombined with the spirit, but absorbs it by slow degrees afterwards. By the manner of distillation of rum, a proportion of volatile oil is also produced in that operation, by the action of the heat on the saccharine matter, in the distilling liquor, which has continued unchanged by the fermentation, and adheres to the still. A part of this oil, likewise, is combined with the spirit in the distillation; and rises united with it: while another part comes over uncombined with the spirit, but unites with it slowly afterwards. The volatile oils that thus come over, without being combined with the spirit, give to fresh distilled rum that rankness of smell and taste, which are sometimes found in it; and the degree of the astringent quality that remains, for want of the spirits being duly corrected by an union with the full proportion of these oils, causes that degree of pungent fiery taste, perceived in it at the same time.

time. But the union with the spirit of the oils, which were uncombined with it in the distillation, going gradually forwards, the whole becomes at length united: and the rank taste and smell of the rum are then converted into such as are grateful. The astringent and coagulating powers of the spirit are of consequence greatly corrected; insomuch that they cease to be noxious to those who drink the rum in moderation.

The corrective power of volatile oils on the injurious qualities of ardent spirit, is much greater than that of dulcification by acids; and these qualities are necessarily much more restrained, or suppressed in rum than in brandy, according to the difference of those distilled spirits with respect to their component substances, as above explained. This may be experimentally verified by trial, if any proper animal substance be steeped for a long time in both: when it will be found, that the plumpness and softness of such substance will be retained much more under the action of the rum than under that of the brandy; though the brandy, if genuine, will not contract and harden it in near so great a degree as pure or rectified spirit.

There is another circumstance attending the combination of volatile oils with ardent spirit, different from that of acids with such spirit. This is, that the union of the two bodies is stronger in the first than in the other; and does not admit of their being so easily separated by redistillation On distilling rum and brandy, it will be found rum will, from this principle, bear that operation with much less change than brandy. For, if the rum distilled be so perfect with respect to the union of the volatile oil with the spirit, either in consequence of its being long kept, or its own original nature, as to be free from all rankness and appearance of fiery quality, it will retain its properties after the second distillation and greatly lose its peculiar smell and flavour, and be brought much nearer to the state of pure ardent spirit. It is to the union of volatile oils with the spirit being stronger than

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that of acids with it, this resistance to a greater separation by distillation must be imputed; and not to the volatility of such oil being greater than that of acids. For if new rum, in which the oils are not perfectly united with the spirit, be distilled, a more considerable change will be perceived in it, and a much greater part of the oil will be found not to come over, than would rise in the case of the same rum kept till it be old: which shews, that the oils not suffering a separation from the spirit by the redistillation of the rum, is not owing to its volatility, but to such a stronger union with the spirit as makes them rise together.

The superiority of rum over brandy arises, therefore, from the spirit's being principally corrected in rum by an union with volatile oils, that more effectually counteract the noxious qualities of pure ardent spirit, than the dulcification by acids, which is the principal corrective in brandy. It must be, however, allowed, that all rum is not equally excellent. For the proportion and qualities of the volatile oils, in the fermented liquor for making rum, vary much, according to the materials produced in different sugar plantations: and the different management of the distillation, with regard to the removing or leaving the matter adhering to the still, has no small share in the goodness of it. In the product of some plantations, a great lengto of time is necessary to bring it to a perfect state; in others, a less. There are not wanting instances likewise, where the *fresh* distilled rum has all the good qualities that are in general to be found in the product of other plantations, after it has had the utmost improvement of time. This peculiarity has, without doubt, its cause in the volatile oil being of such a nature, that the whole of it unites immediately with the spirit in the fermentation and distillation, and renders the rum as perfect at first, as that, where such peculiarity is wrnting, becomes by the most mature age, in consequence of the slow union of the oil and spirit. Where such an extraordinary property has been observed in the rum, it has in general been wholly ascribed to the qualities of the soil on

which

which the sugar canes, affording the materials, were raised: but certainly somewhat of it is, also, owing to the conduct of the distillation. This operation, in the case of the fermented liquor of these materials, may, from their generating a great quantity of volatile oil in the fermentation, admit of a different management to what is generally proper to be practised in the case of common materials, with relation to the keeping the still free from any concreted matter, that will burn if the fluid be drawn off too low; the care of avoiding which, beyond a certain degree, makes the most critical point in the conduct of the distillation. For, if as much burnt oil of saccharine matter, adhering to the still, was produced in the making this kind of rum as the common, it would necessarily acquire time to effect such an union of the oil with the spirit, as whould suppress all the rankness of smell and taste, which it has till they be perfectly united. Whence it is evidently requisite, a cautious regard should be had, that no more oil be produced than is necessary for correcting the spirit, according to the proportion of volatile oil generated in the fermentation: otherwise not only more time is demanded, but the rum will never wholly lose the depravity which the burnt oil, uncombined with the spirit, imparts to it.

That rum is a more safe and wholesome distilled liquor than brandy, is evident from all the several particulars we have above enumerated, with respect to their nature and properties. But, if we examine into the impracticability of obtaining genuine brandy; and consider the mischief and hazard that arise from the free use of the sophisticate or counterfeit kinds, as we shall below explain them and the qualities of the ingredients and the manner of composition, the preference of the use of rum to that of brandy must appear in the most strong and convictive light.

The SIXTH proposition, that *the brandy now generally brought to us from France, and sophisticated by the addition of other distilled spirits,*

 or

or of counterfeit brandy, has similar qualities to pure and ardent spirits, and is consequently noxious to the health of those who drink it freely, is equally certain with any of the preceding: but a more detail examination of various facts is necessary, in order to afford a satisfactory demonstration of the truth of it.

Brandy, to be genuine, ought to be distilled from wine, made of the juice or must of grapes, without the addition of any other matter, either to the must or wine. The sophistications which may be practised on it, are of three kinds: the addition of somewhat that will *produce spirit,* to the *must* before fermentation: the addition of some *other spirit* to the wine before distillation: and the addition of *such* spirit to the brandy itself *after* the distillation.

All these methods have been pursued; and it may, therefore, be proper to point out the particular manner in which they are practised, and the different qualities of the brandy sophisticated in each way, particularly that which is now most followed.

The *first* of the above-enumerated methods of sophistication of brandy, is performed by the addition of other fermentable matter to the Must before the fermentation. This of course increases the quantity of brandy in proportion to the increase of the spirit produced by the matter so added. It was formerly the principal way of sophisticating brandy, and it is the most innocent. It is now much followed, where the wine distilled is made of the Must of the first pressings of the grape; but is, however, practised with respect to the weak Must, obtained from the washings and second pressing, fermented to make an inferior kind of brandy; because that Must is scarcely sufficient of itself to support the due degree of vinous fermentation. This method of sophistication does not produce so bad a kind of spirituous liquor as the other; but the quantity of ardent spirit being augmented by it, in proportion to the native acid of

of the fruit which should dulcify it, in order to render it wholesome, it is, therefore less corrected, and approaches accordingly to that state of purity, in which, as has been repeatedly explained before, the noxious qualities take place. This kind of sophisticate brandy is, evidently from hence, inferior in flavour to the genuine, and, in a certain degree, recedes from the nature of those distilled spirits which are safe and wholesome.

The *second* method of sophistication of brandy is, by adding spirits, already distilled, to the wine, or fermented Must, before the distillation of the brandy. The spirit employed for this purpose at present is that obtained from malt; because it is now much the cheapest that can be procured; but it must be previously rectified for this purpose, and, indeed, for making any palatable spirituous liquor whatever, for reasons I shall have occasion to mention below; and this rectification bringing it to the state of pure ardent spirit, it requires necessarily then the noxious qualities, before shewn, *in proposition the second*, to be found in such spirit. The depravity of this kind of brandy will be the same with that of the first kind of sophistication, but in a greater degree. For the malt-spirit here added to the fermented liquor, being deprived in the rectification of the acetous acid, which all spirits gain in the fermentation and first distillation; and meeting with only a small proportion of uncombined acid in the wine, or fermented Must, for its dulcification there, it will of course come over nearly as so much ardent spirit mixed with the brandy; and will, consequently, in proportion exert its noxious qualities on those who drink it.

The *third*, and by much the most frequent sophistication of brandy, is, by adding other distilled spirits to it after its distillation. This is either done by the addition of simple rectified spirit, or, what is much more general, by that of counterfeit brandy.

In

In the sophistication of brandy by simple rectified spirit, the quantity added must not be large, because it would proportionally diminish the flavour of the brandy, and render its action in the mouth and throat fiery; which, being obvious to the senses, would sink the value of it with regard to the saleable qualities, so as to balance the advantage of the increase of quantity. But in proportion to the quantity of rectified spirit used in this kind of adulteration, the brandy is depraved with regard to its wholesomeness, on the same principles as in the two preceding kinds of sophistication.

The far most general method of sophistication of brandy, by addition after its distillation, is the putting a counterfeit kind to the genuine, which may be done in any proportion. And it unfortunately happens, that this practice is as pernicious in its consequences as frequent in its use; whence it becomes a matter of moment, that the nature and effects of it should be well understood.

In order to shew the faultiness of such brandy as is produced by a mixture of the genuine and counterfeit, it is absolutely requisite to examine the composition and qualities of the counterfeit kind used for that purpose; and this previously demands an investigation of the nature and properties of the ingredients of which it is compounded, as well as of the principles and manner of composition.

This counterfeit brandy is made of malt spirits first rectified; and then again dulcified by re-distillation with acids, principally of the kind called mineral.

The rectification of malt spirit, in order to make brandy, or, as was said before, any other kind of palatable spirituous liquor, is absolutely necessary, on account of its always being impregnated, in the first distillation, with a proportion of empyreumatic oil, commonly called the FAINTS, which gives a very disgustful smell and taste to the spirit.

For

For this reason the malt spirit employed for making counterfeit brandy is constantly re-distilled, in order to its rectification, and some proper substance used in that operation, to assist in keeping down the empyreumatic oil, or *faints*.

The substance most generally now employed in the rectification of malt spirits, for this purpose of keeping down the faints, is a medicinal preparation, called *lapis infernalis;* * which name has been retained for it since it has been applied to this use in distilling. The effect this preparation has in the rectification of malt spirits is, the attracting the empyreumatic oil, or faints, and preventing, consequently, its rising with the spirit; but, unluckily, it also attracts that proportion of acetous, acid generated, as above-mentioned, in the fermentation, by which the spirit is dulcified to a certain degree, and, of course, wholly deprives the spirit of it. This effect of the *lapis infernalis,* together with the re-distillation, brings the ardent spirit to that pure state in which its noxious qualities prevail, according to what is demonstrated in *proposition the second,* and, consequently, though it answers the intended purpose of freeing the spirit of the faints, it causes a great depravity with respect to its wholesomeness.

At

* The *lapis infernalis* is what chemists than called the caustic vegetable alkali, now *pure alkali.* It is maed by adding lime to pearl-ash, pot-ash, or any other vegetable alkaline salt, dissolved in water; and, after they have stood together some time, drawing off the clear fluid, and evaporating it till a dry mass remain. This dry mass is the *lapis infernalis*: which is, in fact, only the alkaline salt, deprived, by the superior attraction of the lime, of the fixt air with which it was comb d before their mixture with each other; and which diminished its caustic power; and varied som of its properties from what they are found to be when it is in a simple state. This preparation has been long known in medicine, as a caustic; and, from the severity of its operation, in that use of it, obtained the name of *lapis infernalis.* It has been much more lately applied to the purposes of distilling, in consequence of its being found to attract empyreumatic oils, such as form what are called the faints in distilled spirits; and to prevent their rising with them.

Some years ago, when an act of Parliament for the encouragement of the exportation of malt spirits was in agitation, it was brought in question, whether the *lapis infernalis,* being a most violent caustic, might not have qualities that would be hurtful to persons who drank the spirit, in the rectification of which it had been used? Those who were examined in the House of Commons on this head, gave their opinion in the negative; and were certainly right with respect to the action of the *lapis infernalis* itself immediately on the persons drinking the spirits; for it does not rise in the distillation; and if it did, a small proportion of it diluted, as it would be in this case, could not be injurious; such quantities of sope-ley, which is only this substance dissolved, as are beyond all comparison greater than what would be thus taken, being given very commonly in medicinal practice. But though the *lapis infernalis* used in the rectification of malt spirits is not, by its own immediate action on those who drink such spirits, hurtful to them; yet, by its effects on the spirit, it is highly injurious, as it reduces the spirit to a noxious state; which, as we shall see below, is not corrected in the subsequent preparation of the counterfeit brandy, but rather aggravated by the addition of another ingredient possessed of the same qualities in a higher degree.

The malt spirit being thus rectified, that is, brought to the state of a pure ardent spirit, indued consequently with all the noxious qualities of such spirit in their full force, a necessity arises that it should be dulcified by a combination with some acid, in order to convert it to counterfeit brandy, by giving it the specious qualities that will make it resemble the true kind. This can only be done by means of such dulcification; and it is requisite that the acid employed should, by its union with the spirit, not only suppress the fiery action of it on the mouth and throat, but impart to it likewise, as far as may be, the peculiar smell and flavour of genuine brandy.

The

The acid which most effectually communicates to pure spirit, by its union with it, the taste and scent of genuine brandy, and is, therefore, principally used in the preparation of counterfeit brandy, is the *nitrous acid,* commonly called *spirit of nitre,* or *aqua fortis.** This acid, when combined with the rectified spirit, raises a flavour and taste much resembling those of brandy, and suppresses the astringent and seemingly fiery effect of the pure ardent spirit on the mouth and throat. But unhappily this combination of the acid of nitre and ardent spirit, from which the counterfeit brandy receives its specious qualities, will not resist the diluting action of water, but suffers the union of them to be destroyed by it, and, consequently, the effects which depended on that union. If a certain proportion of water be mixed

* In the former attempts to make counterfeit brandy, *spiritus nitri dulcis,* or dulcified spirit of nitre, vinegar, and the florentine orris root, were distilled with rectified spirit. The spirituous liquor, thus obtained, had somewhat of the taste and smell of brandy; but not in near so great a degree as that now made by those, who are most masters of their art. The *spiritus nitri dulcis,* which was before only prepared for medicinal uses, was observed to have a strong grateful flavour and scent, resembling those of brandy, which it would impart to rectified spirit of due strength: and it was, therefore, applied to the purpose of making counterfeit brandy. The vinegar, combining in some proportion with ardent spirit, when they are distilled together, and dulcifying it to a certain degree, was, therefore, likewise added for this purpose in the making the counterfeit brandy: but some of the most volatile part is apt to come over in the distillation, uncombined with the spirit; and to give it a raw, sourish smell and flavour, not found in good brandy. The orris-root was used to give the nut-like flavour and smell admired in brandy.

But this method was changed for one cheaper, and yet more effectual for the purpose. The *spiritus nitri dulcis,* which was purchased by the distillers of chemists, or of persons who, preparing it for this purpose, sold it at a good price, was found, if used copiously, an expensive article: and spirit of nitre being the only ingredient in the composition of it, besides rectified spirit, it soon became known, that this acid, in its simple state, might be substituted, with advantage, instead of the *spiritus nitri dulcis.* Whence, as it was also found to answer the end better, as well as more cheaply, it took place of the other; and is now the principal, and, in some cases, the only ingredient added to rectified spirits, to convert them into counterfeit brandy.

mixed with such brandy, a separation of the ardent spirit and acid follow, with respect to the union by which they acted on each other, so as to produce the mutual change that made them resemble brandy; and they only remain mixed with the water as separate and distinct ingredients, having regained their original qualities without any control on each other.*

On this principle we see counterfeit brandy, when mixed with water, or taken into the stomach, where it immediately meets with a considerable quantity of diluting lymph that acts on it as water, is immediately resolved into its two principal elements, pure ardent spirit and spirit of nitre, unrestrained in the action of their proper qualities. The noxious effects on health of pure ardent spirit, we have before investigated in the comment on *proposition the second;* and the spirit of nitre, when its properties are not changed by combination with some other body, has much the same astringent coagulating power as the pure ardent spirit; so that being taken along with the spirit in the counterfeit brandy, instead of correcting its bad qualities, it aggravates them by its own properties; and these two ingredients necessarily act with joint force in injuring the health of those who thus take them, under the specious appearance and name of brandy.

It

* The destruction, by diluting the spirit below proof, of that union or combination of ardent spirit with spirit of nitre, on which the peculiar taste and smell of the compound of them depends, may be demonstrated by the following experiment: Take any quantity of *spiritus nitri dulcis,* which is, as has been shewn above, this same compound; and add to it ten or twelve times its quantity of rectified spirit, in strength at least proof. The mixture will retain the grateful taste and smell of the *spiritus nitri dulcis.* Put together the same quantities of *spiritus nitri dulcis* and water; or even use a much less proportion of water, the peculiar taste and smell will be totally lost in the mixture; and the same effect only will be produced, as if so much ardent spirit and spirit of nitre had been added separately to the water.

It appears hence, that a more noxious preparation of distilled spirit cannot possibly be made, without the actual addition of poisonous substances, than the common counterfeit brandy; as the spirituous part has all the bad qualities of pure ardent spirit; and the other part is formed of an ingredient which has the same in a yet more powerful degree.

With this counterfeit brandy, nevertheless, the far greater part of the sophistication of French brandy for our consumption is made, by mixing them in such proportion as the sordidness of the dealer, or his policy with respect to making the compound most advantageously marketable prompts him to chuse. Sometimes the counterfeit brandy is added to the superior kind of true brandy; but more frequently to the inferior, made, as above-mentioned, of the washings and pressings of the marc of the grapes. This last kind of brandy acquires from the addition of the counterfeit, while the compound remains unmixed with water, a greater proportion of smell and flavour than it had in its simple state.

The sophisticated brandy, thus prepared, will necessarily partake of the bad qualities of the counterfeit kind, in proportion to the quantity mixed with it. This quantity is certainly large in general, otherwise the whole of the distilled spirit produced to market with us, under the name of French brandy, would not be equal by far to the present consumption.

The most perfect brandy, according to the principles here stated, must be greatly depraved and rendered noxious by the mixture of the counterfeit with it. The inferior kind, that in its simple state is faulty, must, consequently, make with it a very pernicious compound. On the whole, therefore, the best kind of sophisticate brandy, though it has the specious appearance of good, is by no means a wholesome spirituous liquor: and the worst kind is a very noxious one. Yet is the

the far greatest part of the brandy that is drank as genuine with us, and by many deemed to be preferable to rum as to wholesomeness, is of this very kind: that is, a compound of some true brandy with the noxious counterfeit preparation.

The SEVENTH proposition, *that the most genuine brandy is inferior in wholesomeness to rum; and that the sophisticate or counterfeit kinds of brandy are very injurious to those who use them in considerable quantities,* is already proved in the comments on the foregoing propositions. It has been shewn, with regard to propositions III. and IV. that the unwholesome qualities of pure ardent spirit are much more effectually corrected in rum than brandy: and the pernicious effects of sophisticated and counterfeit brandy are demonstrated in the comment on *proposition the seventh.* There does not, consequently, remain any occasion here, to dwell on the explanation, or proof of this proposition, as it is a necessary deduction from the others; which have been before demonstrated by clear principles and evident facts.

It may not be improper, however, to take notice of one specious objection, which is frequently brought against rum, by those who would decry its wholesomeness. This objection is, that it contains an empyreumatic oil, which rises on the stomach and disagrees with it in some persons. But this effect, where it happens, is rather an inconvenience than an injury to such persons: as it only causes a disagreeable sensation, but does no real prejudice to the health. The quality of thus rising on the stomach is, moreover, found only in new rum of inferior goodness; where the volatile oil, generated by burning the unfermented sugar in the distillation, abounds too much; or has not had due time to be combined with the spirit. In those cases a separation of such oil is made in weaker stomachs; and occasions a slight degree of heart-burn, of no more consequence than that caused by any thing else eaten or drunk, where the digestion is not perfect. The slight disorder thus produced is therefore merely temporary; and

and does not tend to mischievous consequences, like those caused by the qualities abovementioned, which subsist in brandy, sophisticated, or counterfeit, or other kinds of bad spirituous liquors, in which the spirit is not duly dulcified. But even such a redundance or depravity of the volatile oil is never found in rum, where age is not wanting; or where it was not originally faulty by the neglect of management in the distillation. For no spirituous liquor digests more kindly, or assists digestion more efficaciously, than good rum, sufficiently diluted, and drank in proper quantity. I have indeed seen the use of it effectual in some chronical cases of bad digestion, where all other means of relief have failed.

This objection made unjustly against rum in general, on the score of a quality which is peculiar alone to such as is faulty, ought, however, to induce those who have concerns in the distillation of it, to be extremely careful in that operation. The depravity complained of is owing principally to the rum's being *still-burnt*, as it is called: which happens either from too great a crust of the unfermented sugar, or feculencies in the distilling liquor, being suffered to collect on the sides of the still; or to the not keeping a sufficient quantity of fluid in the still towards the end of the operation. For it is at that time the worst part of the rum rises; what first comes off being generally good; and always the best of the same distillation: as is well known to the sugar-planters; who dilute the first spirit that comes over with spring water; and thence obtain the finest rum, when wanted for their own use. It may be proper, on the same account, to repeat the hint here to those, who keep rum for any long time in their possession, to continue it in the cask; and not to put it in bottles. For, as has been before mentioned, it does not improve in bottles near so much as in the cask.

On the above view of the subject it is clearly evinced, that rum is a much more safe and wholesome liquor than brandy, by arguments drawn

drawn from the principles of chemistry, experiments on the different kinds of distilled spirits, and physiological observation. But there is yet another authority for asserting this important truth. I mean the declared opinion, founded on the observation of physicians and other medical persons of the most extensive practice and acute judgment, who in general agree in allowing rum to be far preferable to brandy with respect to health. This is corroborated, likewise, by the experience of great numbers of others, who have made trial of both these spirituous liquors; and concur in affirming, they have found a difference of their qualities in favour of rum. The comparative effects of rum and brandy on the health have been also noted at sea, where they are particularly distinguishable: when it has happened, that in failure of being able to procure the former, the latter has been substituted, the decline of health that has followed, has been exceedingly conspicuous on change from the use of rum to that of brandy; numbers contracting disorders they were before free from.

In every light of examination, therefore, the preference of rum even to the best brandy, if it could be procured, appears most clearly manifest: and the very strong reason for the use of rum instead of brandy, considering the almost general sophistication of such brandy as is to be now obtained, together with the noxious depravity of it from the sophistication, is also most obviously displayed on incontestible principles. It is, therefore, hoped, that a due regard will be given to this most interesting monition, not to fall into the error here refuted, that brandy is wholesomer than rum; an error replete with so many bad consequences to the public, as well in other respects as from the injury done to the health of those individuals who are so unfortunate as to embrace it.

However unnecessary it may appear, I cannot, after what I have said of the good effects of some spirituous liquors, conclude without giving an earnest exhortation, that they be always drunk with moderation

ration and temperance, otherwise the best may prove detrimental. The limits of the quantum of such spirituous liquors, which constitute this moderation, connot be ascertained or reduced to any rule or standard; as they depend on the difference of climate, constitution of each person, and other particulars, which vary greatly. But, in the case of each individual, whatever quantity infringes on sobriety, or brings on any disorder, should be diminished. It is always proper, likewise, that in the habitual use of distilled spirits, they should be diluted; that is, mixed with water, beer, milk, or some other small liquor; which renders them more mild and gentle in their action on the stomach and intestines. It may be well to observe further, that the too copious use of those very astringent acids, the juice of lemons and limes, along with the distilled spirits, has greatly promoted the injury done to the health of those who have drunk them to excess; and been, in many cases, the sole occasion of the disorders imputed to the distilled spirits. In cachectic and gouty habits such acids, even in smaller quantities, never fail to do harm; and great quantities do mischief in almost every constitution. It is well known, that while the custom of drinking plentifully of small punch, made very sour with lime juice, prevailed in our West-Indian colonies, a much greater number of bad and fatal disseases were contracted than are observed at present among those who drink punch with less acid in proportion to the spirit. The juice of oranges, and milder spirits, taken with the distilled spirits, is less detrimental: but that of lemons and limes ought always to be admitted sparingly, and with caution.—Under these restrictions the use of good spirituous liquors, especially rum, may be deemed innocent in general; and, in some cases above-mentioned, salutary and medicinal.

An exception must be made in all cases of sea scurvy, and other septic cases, where they are peculiarly salutary.

RECTI-

RECTIFICATION

Is a phrase arising out of an operation not known in countries where rum and brandy are prepared, particularly the latter, they being strangers to any other mode of distilling than simply extracting or distilling off the *low wines* or spirits of the first extraction, and recommitting those spirits to the *still*, and *doubling* them, as it is called, or distilling them over again, and which is stiled spirits of the second extraction, or *ardent spirit*, and then the operation of distilling rum and brandy is complete.

In countries where ardent spirit is drawn or prepared from malt or grain, as an humble imitation of *brandy*, they have neither grapes nor wine to enable them to prepare it, as is the case in most of the northern countries of Europe, in which the united kingdoms are included, they substituting grain, sugar, molasses, and other saccharine and fermentable matter instead of wine, with which, as we have now seen, they prepare imitations of brandy; and in the West Indies prepare rum from the sugar cane. A very full description of these interesting operations are given under the their respective heads, where it is shown, how much they differ and fall short in delicacy of flavour from brandy, or ardent spirit drawn from wine, in the southern parts of Europe, where the vine is cultivated, a very interesting description of which may be seen in the *appendix on wines* annexed to this Treatise.

If the reader will look back to the remedies proposed to the *malt distiller*, and to what we have lately said in order to shew him the method and utility of preparing a clean spirit during the process of fermentation and distillation, he may see how much it is the advantage of every one engaged in the malt distillery to avail themselves of the directions there laid down to obtain a pure clean flavourless spirit, which no attempts of the most diligent and intelligent *rectifier* have hitherto been able to obtain from the inefficacious means employed.

A single

A single trial must convince any one pervious to information, or open to conviction, that it is not only to the malt distillers, but the rectifying distillers advantage also, to pursue those instructions, both in the rectifying the raw-spirit, and in sweetening the *feints*.

In the Disquisition on Spirits we have recently seen, that the essential oil which rises in the distillation of ardent spirit, is considered to be principally the flavouring ingredient of the spirit produced; and in proportion as this oil is more or less gross, or more or less abundant, depends the purity and delicacy of the spirit. It has been observed elsewhere in this work, that the grossness of the essential oil is owing, in a great degree, to the fullness, thickness, and richness of the wine, or wash, from which the spirit is drawn, and in a less, to the slovenly manner in which the distilling is hurried on, and sometimes to the wine, or wash, boiling over into the worm, or condenser, which fouls and disflavours the spirit. Perhaps there is not any, or all of these causes together, equal to the use of *alkaline salts*, an abuse destructive to the vinosity and the purity it was, no doubt, intended to correct.

Until the malt-distillers adopt the mode proposed of dulcifying and clarifying their *wash, low-wines, and feints*, I beg leave to recommend the rectifier to try that method of rectifying the raw spirits they purchase from those distillers in a similar manner, and to cleanse and sweeten their feints also, as there laid down, it requiring only to be tried to be adopted.

In Holland, Sweden, Denmark, and the northern parts of Germany, particularly the former, the superiority of their malt-spirit is principally owing to the dilute thin manner they prepare their wash. Nearer home, the Irish and Scotch whiskey is a purer malt-spirit, for the same reason, especially what is prepared for home-consumption,

they not being fettered by the *excise-laws* in a similar manner to the English, with respect to their wash.

It is a known fact, established from common observation in wine countries, that the poorer vintages produce the best brandies. In those provinces in France where the wines are small and thin, the best brandies are produced. In *Cogniac* they distil them three times, not with a view to rectify them, but on account of their being so weak, for which reason their brandies are the strongest exported.

Essential Oils, the product of fermentation succeeded by distillation, are a component part of ardent spirit. By the dulcification of alkohol with the *mineral acids,* and in a great degree by the *acetous acid,* it is convertible to the essential oil of wine, and vinous products. By the assistance of *manganese* and the sulphuric acid, alkohol is convertable to *vinegar*; hence there are not means wanting to convert vinegar to wine, or ardent spirit.

Leaving these investigations to another place, it must not at present be forgot, that these essential oils are more or less *caustic,* notwithstanding their demulcent and obtunding qualities on ardent spirit, which they are presumed so eminently to dulcify, and of which they are known to be a component part.

It may be seen in the Appendix, under the component parts of *Wine,* that a fine saline matter rises in distillation from wine, as well as an essential oil, which also becomes part of the subsequent spirit; this is spirit in a *nascent state,* and probably the principal corrector and dulcifier of the ardent qualities of *vinous spirit.* It will be presently shewn, that the whole of alkohol, or rectified spirit, is convertable to *oil of wine*; and, *vice versa,* the oil of wine convertable to ardent spirit.

There

Rectification is an operation there are several methods of performing; though some, and indeed those in general practised by our distillers, hardly deserve the name; because, instead of rectifying, that is freeing the spirit from its gross essential oil and phlegm, they alter the natural flavour of the spirit that comes over in the operation.

The principal business of rectification is to separate the spirit from the essential oil of the malt, &c. which is very apt to adhere strongly to the spirit. And in order to this, care should be taken in the first distillation; that is, the spirit, especially that from malt or grain, should be drawn by a gentle fire, by which means great part of the essential oil will be kept from mixing with the spirit; for experience has abundantly proved, that it is much easier to keep asunder, than to separate them when once mixed.

But as it is almost impossible to draw low wines without the spirit being in some measure impregnated with an over proportion of the essential oil, it is absolutely necessary to be acquainted with some methods of separating the spirit from the oil, and also of freeing it foom its phlegm. The best methods of doing this to perfection, are re-distillation and percolation.

In order to rectify low wines, they should be put into a tall body, or alembic, and gently distilled in *balneum mariæ;* by this means a large proportion, both of oil and phlegm, will remain in the body. But if the spirit should be found, after this operation, to contain somewhat too much of the essential oil, it must be let down with fair water, and re-distilled in the same gentle manner. And thus it may be brought to any degree of purity; especially if in the working the spirit be suffered to fall into a proper quantity of fair water. But it must be remembered, that it is much more difficult to cleanse alkohol, or proof-spirit, than low wines, because the oil is more intimately mixed with the two former than with the latter. This redundant

oil may however be separated from proof-spirit, &c. by the method already proposed, especially if it be previously filtrated through paper, thick flannel, sand, stone, &c; at the bottom of each placing some cotton wool, for taking up the oil that escapes the filter.

But this method, though it effectually answers the intention, is generally rejected by our distillers, because of the slowness of the operation; and caustic alkalies substituted in its stead; though instead of freeing the spirit from the oil, they only abolish the natural flavour of the spirit, and make a more intimate mixture between the particles of the spirit, and those of the essential oil, out of the sphere of their attraction.

It is impossible to enumerate all the methods practised by distillers, as almost every one pretends to have a secret nostrum for this purpose. The principal methods in use for rectifying malt spirits, are however reducible to three, namely, by fixed alkaline salts, by acid spirits mixed with alkaline salts, and by saline bodies, and flavouring additions.

The method of rectifying by alkaline salts is thus performed; to every piece of proof-spirit add fourteen pounds of dry salt of tartar, fixed nitre, or calcined tartar; lute on the head, and distil by a gentle heat, but be very careful to leave out the feints. By this method a large proportion of the fœtid oil will be left in the still; and what comes over with the spirit will be greatly attenuated. But this operation is generally performed in a very different manner; for, instead of distilling the spirit in a gentle and equable manner, the still is worked in its full force; by which means the oil, which should have remained in the still, is driven over, and intimately mixed with the spirit; and consequently, the whole operation frustrated, and the spirit rendered much harder to cleanse than it was before.

But even when the operation is performed according to the rules of art,

art, it is far from being perfect; for it is well known, that part of the fixed salts become volatile in the operation, pass over the helm, and intimately mix with the essential oil still contained in the spirits: by this means the oil becomes more perfectly united with the spirits, and consequently much harder to be separated by repeated distillations. Nor is this all; for the still being worked in its full force, the bitter oil of the malt, formed into a kind of liquid soap in the still by means of the alkaline salt, is brought over the helm with the feints, and suffered to mix with the spirit, whereby it is rendered almost as nauseous and ill-tasted as before the operation. Besides, if this operation were performed in its utmost perfection, it would never answer the intention; for the alkaline salt destroys the vinosity of the spirit, and consequently deprives it of one of its most valuable properties. Our distillers are well acquainted with the defect in the operation, and endeavour to supply it by an addition of acids. This is what we call the second method by alkalies and acids.

The operation of rectifying by the method of fixed alkalies and acids, is the same as that above described; the spirit is drawn over from fixed alkalies as before; but, in order to mortify the alkali in the spirit, and restore its vinosity, a proper quantity of some acid spirit is added. Various kinds of acids are used on this occasion; but principally those of the mineral kind, because of their cheapness; as oil of vitriol, spirit of nitre, oil of sulphur, and the like. We would, however, caution a young distiller from being too busy with these corrosive acids: the sulphureous spirit of vitriol, dulcified spirit of nitre, or Mr. Boyle's acid spirit of wine, well rectified, will much better answer his purpose; but particularly the *acid of tartar* mentioned below.

The third method of rectification is that by saline bodies, and flavoring ingredients. There is no difference in the operation between this and the two foregoing methods; fixed alkaline salts, common salt decrepitated

decrepitated or dried, calcined vitriol, sandiver, alum, &c. is put into the still with the low wines, and the spirit drawn over as before. When the quantity is drawn off, the flavouring ingredients are added to give the spirit the flavour intended. But, as the spirit is not by this means rendered sufficiently pure, the disagreeable flavour of the spirit generally overpowers that of the ingredients, whereby the whole intention is either destroyed, or a compound flavour produced, very different from that intended.

Some distillers, instead of alkaline salts, use quick lime in rectifying their malt spirit; this ingredient cleanses and dephlegmates the spirit considerably; but, like that rectified from alkaline salts, it requires an alkaline disposition, and also a nidorous flavour. Acids, therefore, are as necessary to be mixed with those spirits rectified with quick lime, as with those rectified with an alkaline salt. If chalk, calcined and well purified animal bones, &c. were used in stead of quick lime, the spirit would have a much less alkaline or nidorous flavour; and, consequently, the flavouring ingredients might be added to it with more success than can be expected from a spirit rectified from alkaline salts or earths.

But, perhaps, if neutral salts were used instead of the alkaline ones, the spirit might be rendered pure, without contracting an alkaline flavour; soluble tartar might be used for this purpose, though the spirit acquires from hence a little saponaceous flavour. Dr. Cox has mentioned another method for this purpose, namely, to deprive the volatile salts of their oil, by rendering them neutral with spirit of salt, and afterwards subliming them with salt of tartar: the acid may be varied, if the spirit of salt should not be found so well adapted to the purpose as could be wished: but fine dry sugar seems the best adapted to the purpose of rectifying these spirits; as it readily unites with the essential oil, detains and fixes it, without imparting any urinous, alkaline, or other nauseous flavour to the spirits rectified upon it.

Thus

Thus have I considered the principal methods used by our distillers, in rectifying their spirits; and shall conclude this chapter with remarking, that there is no other way of rectifying to perfection, besides what we first laid down, namely, by gentle distillation, and employing the *additions* recommended for the *wash, low-wines*, and *feints*. But then it must be remembered, that the whole process must be of a piece: we mean, that the first distillation from the wash must be performed in a gentle manner; for otherwise an over proportion of the essential oil will be so intimately blended with the spirit, as not to be easily separated by re-distillation. Another good property attending this method is, its universality; all kinds of spirits, from whatever ingredients extracted, require rectification; and this is adapted to all kinds.

OF THE FLAVOURING OF SPIRITS.

We have observed in the two preceding chapters, that the common method of rectifying spirits from alkaline salts destroys their vinosity, and in its stead introduces an urinous or lixivious taste. But as it is absolutely necessary to restore, or at least substitute in its room, some degree of vinosity, several methods have been proposed, and a multitude of experiments performed, in order to discover this great *desideratum:* but none hitherto has succeeded equal to the spirit of nitre; and accordingly this spirit, either strong or dulcified, has been used by most distillers to give an agreeable vinosity to their spirits.

Several difficulties, however, occur in the method of using it; the principal of which is, its being apt to quit the liquor in a short time, and consequently depriving the liquor of that vinosity it was intended to give. In order to remove this difficulty, and prevent the vinosity from quitting the goods, the dulcified spirit of nitre, which is much better than the strong spirit, should be prepared by a previous

digestion

digestion continued for some time with alcohol; the longer the digestion is continued, the more intimately will they be blended, and the compound rendered the milder and softer.

After a proper digestion, the dulcified spirit should be mixed with the brandy, by which means the vinosity will be intimately blended with the goods, and disposed not to fly off for a very considerable time.

No general rule can be given for the quantity of this mineral acid requisite to be employed, because different proportions of it are necessary in different spirits. It should, however, be carefully adverted to, that though a small quantity of it will undoubtedly give an agreeable vinosity, resembling that naturally found in the fine subtile spirits drawn from wines, yet an over large dose of it will not only cause a disagreeable flavour, but also render the whole design abortive, by discovering the imposition. Those, therefore, who endeavour to cover a foul taste in goods by large doses of dulcified spirit of nitre, will find themselves deceived.

But the best, and indeed the only method of imitating *French* brandies to perfection, is by an essential oil of wine and acid of tartar, they being the only things that give the *French* brandies their flavour. It must, however, be remembered, that in order to use even these ingredients to advantage, a pure, tasteless spirit must be first procured; for it is ridiculous to expect that this essential oil and tartarous acid should be able to give the agreeable flavour of *French* brandies to our fulsome malt spirit, already loaded with its own nauseous oil, or strongly impregnated with a lixivious taste from the alkaline salts used in rectification. How a pure insipid spirit may be obtained has been already considered in some of the preceding chapters; it only therefore remains to shew the method of procuring this essential oil of wine, and acid of tartar, which is this:

For

For the essential oil, take some cakes of dry wine lees, such as are used by our hatters; dissolve them in six or eight times their weight of water, distil the liquor with a slow fire, and separate the oil by the separating glass; reserving for the nicest uses that only which comes over first, the succeeding oil being coarser and more resinous.

* For the Acid of Tartar.—Take one pound of cream of tartar dissolved, or boiled in six pounds of water; add a quarter of a pound of strong oil of vitriol, by little and little at a time. When a complete solution is obtained, the fluid will then contain disengaged acid of tartar, together with vitriolated tartar, or the neutral salt, formed by the union of the vitriolic acid, with the vegetable alkali of the cream of tartar. The vitriolated tartar, being a salt of sparing solubility, will be precipitated by continuing the boiling; when the liquor is evaporated to one half, it is to be filtered; and upon further evaporation if any thing more is precipitated, it must be filtered again. The clear filtered liquor being then reduced to the consistence of a syrup, and set by in a temperate or rather warm place, will afford fine crystals of tartareous acid, equal in weight to half the cream of tartar employed.

If too small a quantity of vitriolic acid has been used, part of the cream of tartar will not be decomposed, but will separate from the liquor along with the vitriolated tartar; it is better therefore to use too little, rather than too much oil of vitriol.

The crystals or acid of tartar do not change by exposure to the air; they are much more soluble in water than cream of tartar itself.

These acid crystals are convertable to vinegar by digestion with water and ardent spirits.

* Shannon on the Diseases of Hot Climates.

This is the true vinous acid, part of which is that volatile saline matter subsequently remarked to come over the helm in distillation when wine prepared from the juice of the grape is distilled for brandy; consequently gives that salinity which, when added with the essential oil of wine and blended with a flavourless spirit, forms genuine brandy. See the component parts of wine in the Appendix.

Having procured this fine oil of wine, it may be mixed into a quintessence with pure alkohol, in which it readily dissolves; by which means it may be preserved a long time fully possessed of all its flavour and virtues; but without such management, it will soon grow resinous and rancid.

When a fine essential oil of wine and pure acid of tartar are thus procured, and also a pure and insipid spirit, *French* brandies may be imitated to perfection both with regard to the flavour and quality. It must, however, be remembered, and carefully adverted to, that the essential oil be drawn from the same sort of lees, as the brandy to be imitated was procured from; we mean, in order to imitate *coniac* brandy, it will be necessary to distil the essential oil from *coniac* lees; and the same for any other kind of brandy. For as different brandies have different flavours; and as these flavours are owing principally to the essential oil of the grape, it would be preposterous to endeavour to imitate the flavour of *coniac* brandy with an essential oil procured from the lees of *Bourdeaux* wine.

When the flavour of the brandy is well imitated by a proper dose of the essential oil and acid of tartar, and the whole reduced into one simple and homogeneous fluid, other difficulties are still behind: the flavour, though the essential part, is not however the only one; the colour, the proof and the softness must be also regarded, before a spirit, that perfectly resembles brandy, can be procured. With regard to the proof, it may be easily hit, by using a spirit rectified above

proof;

proof; which, after being intimately mixed with the essential oil of wine, may be let down to a proper standard by fair water, to be regulated by the hydrometer. And the softness may in a great measure be obtained by distilling and rectifying the spirit with a gentle fire; and what is wanting of this criterion in the liquor, when first made, will be supplied by time, assisted by the acid of tartar; for it must be remembered, that it is time principally that gives this property to *French* brandies; they being at first like our spirits, acrid, foul, and fiery. But with regard to the colour a particular method is necessary to imitate it to perfection: and how this may be done shall now be considered.

THE ORDINARY METHOD OF COLOURING SPIRITS.

The art of colouring spirits owes its rise to observations on foreign brandies; this observation is applicable to all sprits long kept in the wood, that is, in oak casks. A piece of *French* brandy that has acquired by age a great degree of softness and ripeness, is observed at the same time to have acquired a yellowish brown colour; and hence our distillers have endeavoured to imitate this colour in such spirits as are intended to pass for *French* brandy. And, in order to this, a great variety of experiments has been made on various substances, in order to discover a direct and sure method of imitating this colour to perfection. But, in order to do this, it is necessary to know from whence the *French* brandies themselves acquire their colour; for till we have made this discovery, it will be in vain to attempt an imitation; because, if we should be able to imitate exactly the colour, which is indeed no difficult task, the spirit will not stand the test of different experiments, unless the colour in both be produced from the same ingredient.

This being undeniably the case, let us try if we cannot discover this

mighty secret: the ingredient from whence the *French* brandy acquires its colour.

We have already observed, that this colour is only found in such brandies as have acquired a mellow ripeness by age; it is therefore not given it by the distiller, but has gained it by laying long in the cask. Consequently, the ingredient from whence this colour is extracted, is no other than the wood of the cask, and the brandy in reality is become a dilute tincture of the gum-resinous part of the oak.

The common experiment used to prove the genuineness of *French* brandy proves, that this opinion is well founded. The experiment is this: they pour into a glass of brandy a few drops of a solution of calcined vitriol of iron in a diluted spirit of sulphur, or any other mineral acid, and the whole turns of a blue colour; in the same manner as we make ink of a tincture of galls and vitriol. A solution of green vitriol in three times its weight of water will do.

Since, therefore, the colour of *French* brandies is acquired from the oak of the cask, there is no difficulty in imitating it to perfection. A small quantity of the extract of oak, or the shavings or saw-dust of that wood, properly digested, will furnish us with a tincture capable of giving the spirit any degree of colour required. But it must be remembered, that as the tincture is extracted from the cask by brandy, that is alkohol and water, it is necessary to use both in extracting the tincture; for each of these menstruums dissolves different parts of the wood. Let, therefore, a sufficient quantity of oak shavings or saw-dust be digested in strong spirit of wine; and also at the same time other oak shavings be digested in water; and when the liquors have acquired a strong tincture from the oak, let both be poured off from the shavings, into different vessels, and both placed over a gentle fire till reduced to the consistence of treacle. In this condition, let the two extracts be intimately mixed together; which

which may be done effectually by adding a small quantity of loaf sugar, in fine powder, and well rubbing the whole together. By this means a liquid essential extract of oak will be procured, and always ready to be used as occasion shall require. A digestion in proof-spirit is more simple, less troublesome, and equally efficacious, which may be laid by and occasionally used as wanted, without the trouble of evaporation.

There are other methods in use for colouring brandies; but the best, besides the extract of oak above-mentioned, are common treacle and burnt sugar.

The treacle gives the spirits a fine colour, nearly resembling that of *French* brandy; but as its colour is but dilute, a large quantity must be used; this is not however attended with any bad consequences; for notwithstanding the spirit is really weakened by this addition, yet the bubble proof, the general criterion of spirits, is greatly mended by the tenacity imparted to the liquor by the treacle. The spirit also acquires from this mixture a sweetish or luscious taste, and a fulness in the mouth; both which properties render it very agreeable to the palates of the common people, who are, in fact, the principal consumers of these spirits.

A much smaller quantity of burnt sugar than of treacle will be sufficient for colouring the same quantity of spirits; the taste is also very different; for, instead of the sweetness imparted by the treacle, the spirit acquires from the burnt sugar an agreeable bitterness, and by that means recommends itself to nicer palates, which are offended with a luscious spirit. The burnt sugar is prepared by dissolving a proper quantity of sugar in a little water, and scorching it over the fire till it acquires a black colour. Molasses without the addition of water is of a proper consistence to burn, and is the colouring substance used, it is heated to ebulition, set on fire, and extinguished when

burnt

burnt enough. Its colour is deepened, but its transparency not effected by the burning.

Either of the above ingredients, treacle or burnt sugar, will nearly imitate the genuine colour of old *French* brandy; but neither of them will succeed, when put to the test of the vitriolic solution.

Thus have I traced the subject of distillation from its origin; shewn the methods commonly made use of by distillers, and pointed out various improvements that might be introduced into this art with great advantage; and shall conclude this part with recommending the several hints to those distillers who are desirous of improving their art, and proceeding on a rational foundation, it being from such only that improvements are to be expected; for where the operations are constantly carried on in the same beaten tract, it is in vain to expect improvements, unless chance should be kind enough to throw that in their way, which a rational theory would have easily led them to discover.

OF GIN.

There was formerly kept in the apothecaries' shops a distilled spirituous water of juniper, the medicinal advantages of which are too well known to have it expunged yet; but the vulgar being fond of it as a dram, the distillers supplanted the apothecaries, and sold it under the name of Geneva. The common sort, however, is not made from juniper-berries, as it ought to be, but from oil of turpentine. The method of preparing which, we shall give in the sequel of this chapter.

Juniper-berries are a roundish fruit, of the size of a pea. They wither and wrinkle in the drying, and we meet with them variously corrugated, and usually covered with a bluish resinous dust when fresh

fresh. They should be chosen fresh, plump, full of pulp, and of a strong taste and smell. They are usually imported from *Germany*, though we have plenty of the trees in *England*. It is but small with us, rarely rising to more than three or four feet in height, and scarce ever exceeding five or six. Some of the juniper shrubs are males, some females of the same species; the male shrubs produce in April or May a small kind of juli with apices on them, very large, and full of farina; the females produce none of the juli, but only the berries, which do not ripen till the second year, and then do not immediately fall off, so that it is no uncommon thing to see three sets of berries, or the fruit of three different years at once on the same tree.

If you make use of *English* berries, let them be fully ripe before they are gathered; and in order to preserve them, spread them very thin on a boarded floor, leaving the windows and doors open, and turn them once a day till they are dry; after which pack them up in barrels, so that no air may come to them, and they will keep good all the year. Some, when they are dry, throw them altogether in a corner of the room, where they continue till wanted for use: but the berries will not keep so well by this method as when packed in casks, they being subject to contract a mouldiness, which will give a taste to the goods greatly to their disadvantage.

Some distillers, as soon as their berries are gathered, put them into casks, and cover them with spirits of wine, by this method the berries are indeed well preserved, without any danger of contracting an ill smell, which they are very apt to do by the other methods, unless the greatest care be taken; but then it must be remembered, that the spirit will extract great part of their essential oil, in which their virtues consist, and consequently the berries themselves will be rendered of little value. If, therefore, you preserve your berries in this manner, you should put into each cask or jar, only the quantity you

use

use for one charge of your still; and when you have occasion to use them, put both the spirits and berries into your alembic.

Thus your berries will be finely preserved, without any loss either of their essential oil, or the spirits made use of to preserve them.

RECIPE FOR MAKING TEN GALLONS OF GENEVA.

Take of juniper-berries, three pounds; proof spirit, ten gallons; water, four gallons. Draw off by a gentle fire till the feints begin to rise, and make up your goods to the strength required with clean water.

The distillers generally call those goods which are made up proof by the name of Royal Geneva; for the common sort is much below proof, ten gallons of spirit being sufficient for fifteen gallons of Geneva. Nay, what is generally sold at the common alehouse is made in the following manner:

Take of ordinary malt spirits, ten gallons; oil of turpentine, two ounces; juniper berries, one pound; sweet fennel and carraway seeds, of each four ounces; bay salt, three handfuls. Draw off by a gentle fire till the feints begin to rise, and make up your goods to the strength required with clean water.

In this manner is the *common Gin* made, and it would be surprizing that people should accustom themselves to drink it for pleasure, were they not convinced of its cordial and innocent effects, compared to similar excesses committed with foreign spirits, which are also much more expensive.

There is a sort of this liquor called *Holland's* Geneva, from its being imported from *Holland*, which is greatly esteemed.

The

The ingredients used by the *Dutch* are, however, the same as those given in the first recipe of this chapter, only instead of malt spirit they formerly used *French* brandy. We have sufficiently shewn the nature of *French* brandy, and in what its excellence consists; and, also, that by the help of a clean spirit, cordial waters may be made with the same goodness as those drawn with *French* brandy. If, therefore, the distiller is careful in distilling and rectifying his malt spirit, it is thought he might make Geneva equal to that of the *Dutch*, provided it be kept to a proper age; for all spirituous liquors contract a softness and mellowness by age, not often effectually imitated by art. We must here again observe the legal disability interposed by the Excise laws disables our Distillers from making so thin or dilute a wash as the Hollanders, and, consequently, so clean a spirit. *See pages* 18 and 96, where this is more fully explained, and counteracted by means proposed to the malt-distiller and rectifier.

OF CHERRY BRANDY.

This liquor is greatly called for in the country; and is made different ways. Some press out juice of the cherries, and having dulcified it with sugar, add as much spirit to it as the goods will bear, or the price it is intended to be sold for. But the common method is, to put the cherries, clean picked, into a cask, with a proper quantity of proof spirit; and after standing eighteen or twenty days, the goods are drawn off into another cask for sale, and about two-thirds of the first quantity of spirits poured into the cask upon the cherries. This is suffered to stand about a month to extract the whole virtue from the cherries, after which it is drawn off as before; and the cherries pressed to take out the spirit they had absorbed. The proportion of cherries and spirit is not very nicely observed; the general rule is, to let the cask be about half filled with cherries, and then filled up with proof spirits. Some add to every twenty gallons of spirit, half an

ounce

ounce of cinnamon, an ounce of cloves, and about three pounds of sugar, by which the flavour of the goods is considerably increased. But in order to save expences, not only the spices and sugar are generally omitted, but also a great part of the cherries, and the deficiency supplied by the juice of elder-berries. Your own reason, therefore, and the price you can sell your goods for, must direct you in the choice of your ingredients.

By the same method you may make raspberry brandy; and if the colour of the goods be not deep enough, it may be improved by an addition of cherry brandy, elder-juice, or other colouring substance, as log-wood.

RASPBERRY BRANDY.

Raspberry brandy is in less demand in the country than cherry brandy is; and is infused much after the same manner with cherry brandy, and drawn off, and made fit for sale with about the same addition of brandy to what you draw off from the first, second, and third infusion, and dulcifyed accordingly, first making it of a bright deep colour; but omitting cinnamon and cloves in the first, but not in the second and third infusion.

The first infusion will be of a colour deep enough without help or art to it; the second infusion will be somewhat paler, and must be made deeper colour'd, by adding cherry brandy about a quart to ten, or more gallons of the said raspberry brandy; and the third infusion will take more cherry brandy to colour the raspberry, which your own judgment will direct you in; here also you may assist the colour and flavour with the juice of the elder-berry.

TO

TO MAKE ELDER JUICE.

When you make elder juice let your berries be fully ripe, and all the stalks (which are very many) be clean picked from them; then if you have a press for drawing all the juice from them, have ready four or five hair cloths somewhat broader than your press, and lay one layer above another, having a hair cloth betwixt every layer, which must be laid very thin, and pressed first a little, and then more, till your press be drawn as close as you can; then take out the berries, and press all you have in the like manner; then take your pressed berries, and break out all the lumps, and put them into an open-headed vessel, and put upon them as much liquor as will just cover them, and let them infuse so for seven or eight days, and put your best juice into a cask proper for it to be kept in, and put one gallon of malt-spirits not rectified to every twenty gallons of elder juice, which will effectually preserve it from becoming sour for one or two years at least.

USQUEBAUGH.

Usquebaugh is a very celebrated cordial, the basis of which is saffron. There are different ways of making this famous Irish Cordial; but the following are equal to any I have seen:

Recipe for Ten Gallons of common Usquebaugh.

Take of nutmegs, cloves, and cinnamon, of each two ounces; of the seeds of anise, carraway, and coriander, each four ounces; liquorice-root sliced, half a pound; bruise the seeds and spices, and put them together with the liquorice into the still, with eleven gallons of proof spirits, and two gallons of water; distil with a pretty brisk

 fire

fire till the feints begin to rise. But as soon as your still begins to work, fasten to the nose of the worm two ounces of *English* saffron tied up in a cloth, that the liquor may run through it, and extract all its tincture; and, in order to this, you should often press the saffron with your fingers. When the operation is finished, dulcify your goods with fine sugar.

Recipe for making Ten Gallons of Royal Usquebaugh.

Take of cinnamon, ginger, and coriander-seed, each three ounces; nutmegs, four ounces and an half; mace, cloves, and cubebs, of each one ounce and an half. Bruise these ingredients, and put them into an alembic, with lemon and orange peel, pared off thin, four ounces of each dried, or double the quantity of fresh peeled, and eleven gallons of proof spirit and two gallons of water; and distil till the feints begin to rise; fastening four ounces and an half of *English* saffron, tied in a cloth, to the end of the worm, as directed in the preceding recipe. Take raisins, stoned, four pounds and an half; dates, three pounds; liquorice-root, sliced, two pounds; digest these twelve hours in two gallons of water; strain out the clear liquor, add it to that obtained by distillation, and dulcify the whole with fine sugar.

Recipe for making Ten Gallons of Usquebaugh by Digestion.

Take of raisins, stoned, five pounds; figs, sliced, one pound and an half; cinnamon, half a pound; nutmegs, three ounces; cloves and mace, of each one ounce and an half; liquorice, two pounds; saffron, four ounces; bruise the spices, slice the liquorice, and pull the saffron in pieces; digest these ingredients eight days in ten gallons of proof spirit, in a vessel close stopped; then filter the liquor, and add to it two gallons of *Canary* wine, and half an ounce of the tincture of ambergris.

Recipe

Recipe for making Ten Gallons of French *Usquebaugh.*

Take of saffron three ounces; of the essential oil, or essence of Florentine citron, bergamot, *Portugal* orange and lemon, of each an hundred drops; angelica-seed, vanellos, and mace, of each one ounce and an half; cloves and coriander-seed, of each three-quarters of an ounce; bruise the seeds and spices, and put all into an alembic with eleven gallons of proof spirit, and two gallons of water; draw off with a gentle fire till the feints begin to rise, fastening to the nose of the worm four ounces of saffron, in a cloth. When the operation is finished, dulcify the goods with fine sugar.

These waters are excellent cephalic cordials, and alexipharmics; and are excelled by nothing in suddenly reviving the spirits when depressed by sickness, &c. They also expel the gout from the stomach.

RATAFIA.

Ratafia is a liquor in great estimation, and most persons are acquainted with it; though the true method of making it is known only to a few. There are various kinds of ratafia made from different fruits. I shall give recipes for making those which are at present in most esteem; which may serve as instances for making these goods from any other kinds of fruit.

Recipe for making Ten Gallons of the common Ratafia in Use.

Take of nutmegs, eight ounces; bitter almonds, ten pound; *Lisbon* sugar, eight pounds, ambergris, ten grains: infuse these ingredients three days in ten gallons of clean proof spirit, and filter through a flannel bag for use.

The

The nutmegs and bitter almonds must be bruised; and the ambergris rubbed with the *Lisbon* sugar in a marble mortar, before they are infused in the spirit; or, take nutmegs and allspice, of each two ounces; of the bitter almond cake, from which the oil is expressed, one pound; of cassia-buds, four ounces; and proceed as with the former; sweeten to your palate, and colour with cherry brandy.

WHITE RATAFIA.

As red fruits are the basis of that called red ratafia, so, on the contrary, that made from the juices of white fruits is denominated white ratafia.

There are various kinds of ratafia made from various fruits; but I shall only give recipes for making three or four sorts, which will be sufficient for all the rest, as the method is nearly the same in all.

Recipe for making Ratafia from the Muscat, or white Frontiniac Grape.

The berries of this kind of grape are large, and grow extremely close upon the bunches, which are very long, and have commonly two shoulders; the fruit, when ripe, has a rich musky flavour; but it is commonly very late in autumn before these grapes are in perfection; and the berries being so very close upon the bunches, detain the moisture in the centre, so that they often perish: to prevent which, some curious persons look over their vines, soon after the grapes are formed, and with a pair of scissars, cut out all small ones, so as to leave the others at a moderate distance, whereby the sun and air are easily admitted, which dissipates the moisture, and prevents their perishing. There is another kind of this grape, called by some the white *Frontiniac* of *Alexandria*, and by others the *Jerusalem* muscat, which is

is a very large grape, and when ripe, an excellent fruit; but is rarely brought to perfection in *England*. The berries of the *Jerusalem* muscat are of an oval shape, and very large. They grow very loose on the bunches, are very fleshy and firm, and when ripe, are of a greenish white, and a delicate flavour.

Either of these kinds of grapes will make very fine ratafia; but whichever of them are chosen, they must be picked from the stalks, and only the finest berries made use of. The stones must also be picked out; for if they are bruised with the berries, the fine flavour of the juice will be greatly diminished.

When you have picked the grapes from the stalks, and taken out the stones, press out the juice, and filtrate it through a flannel bag. Then add the quantity of sugar and spirit, and flavour it to your mind, with a spirit distilled from spices, in the manner explained below.

The general proportion of sugar and spirit is, to twenty pints of the juice, five pounds and an half of sugar, ten pints of spirit, and what quantity you please of the spicy spirit.

To make the spicy spirit, take of mace, one pound; nutmegs, four ounces; spirit, three gallons; and draw off the whole in *balneum mariæ*.

By the same method you may make RED RATAFIA from the red *Frontiniac;* except that the grapes, when bruised, must be suffered to ferment three or four days before the juice is pressed out; because the colour, which resides principally in the skins of the grapes, will by that means be extracted.

The berries of the red muscat, or red *Frontiniac,* are about the size of

of those of the white; but grow much thinner on the bunches. This grape, when thoroughly ripe, has the richest and highest flavour.

There is also another method practised in making ratafia, which is this: take the quantity of fruit proposed, bruise it, and immediately pour the spirit on the pulp. After standing a day or two, express the juice and spirit, filter it, and add the sugar and spices as before. But this method requires more spirit than the former, as it will be impossible to press it all out of the skins, and other parts of the fruits remaining, after the juice is extracted.

Of making fine and dry Ratafia from red Fruit.

Though the ratafia we have just mentioned will doubtless please the palates of many people; yet there are others who would prefer a different sort; it is therefore necessary to know how to make dry as well as sweet ratafia, if we are desirous of pleasing all sorts of palates.

Dry ratafia is prepared in the same manner as the preceding, but the ingredients are different.

An equal quantity of cherries and gooseberries are necessary in making dry, or sharp, ratafia; because the acidity of the gooseberries gives the requisite flavour to this sort of liquor; but, at the same time care must be taken, that the gooseberries be fully ripe; for otherwise, though gooseberries are more acid before they are ripe than afterwards, yet that acidity is not the flavour desired; it is acerb and rough, and will render the flavour of the ratafia disagreeable. The same observation holds good also with respect to the cherries; they must be fully ripe, as in making the soft ratafia.

Instead

Instead of the black cherries used in the composition of the preceding ratafia, mulberries should be used in this: the reason for this change is, that the juice of the black cherry is more sweet and glutinous than that of the mulberry, and therefore less fit for making the ratafia. But the mulberries must be the ripest and blackest possible, in order to give the better colour to the liquor.

More spirit and less sugar in proportion to the juice of the fruit is also required in this composition than in the foregoing; but with regard to the spices, the same quantity is generally added to both.

Recipe for making Red Ratafia fine and dry.

Take of cherries and gooseberries, of each thirty pounds; mulberries, seven pounds; raspberries, ten pounds. Pick all these fruits clean from their stalks, &c. bruise them, and let them stand twelve hours; but do not suffer them to ferment. Press out the juice, and to every pint add three ounces of sugar; when the sugar is dissolved, run it through the filtering bag, and to every five pints of liquor add four pints of clean proof spirit; together with the same proportion of spirit drawn from the spices in the foregoing composition.

But it may not be amiss to observe here, that different distillers use different quantities of the spirit drawn from spices. The best method therefore is to imitate the flavour most universally approved of, which may be easily done, by adding a greater or less proportion of the spiced spirit.

ANISEED CORDIAL.

Aniseed is a small seed of an oblong shape, each way ending in an obtuse point; its surface is very deeply striated, and it is of a soft and

lax substance, very light, and easily broken. Its colour is a kind of olive, or greenish grey; it has a very strong and aromatic smell, and a sweetish but acrid taste, but in the whole not disagreeable. Aniseed should be chosen large, fair, new, and clean, of a good smell and acrid taste. The plant that produces it is cultivated in many parts of *France*; but the finest seed comes from the island of *Malta*, where it is raised for sale, and whence a great part of *Europe* is supplied.

Recipe for Ten Gallons of Aniseed Cordial.

Take of aniseed bruised, two pounds; proof spirit, twelve gallons and an half; water, one gallon; draw off ten gallons, with a moderate fire. Or,

Take of the seeds of anise and angelica, each two pounds; proof spirit, twelve gallons and an half; draw off as before.

Aniseed cordial should never be reduced below proof, because of the large quantity of oil with which the spirit is impregnated, and which will render the goods milky and foul, when brought down below poof; but if there be a necessity for doing this, the goods must be passed through the filtering bag, which will restore their transparency.

Aniseed cordial is a good carminative, remarkably comforting the bowels, and therefore in great request among the common people against the cholic. The oil of aniseed has been lately found to cure the rheumatism.

CARAWAY CORDIAL.

Caraway seed is of an oblong and slender figure, pointed at both ends, and thickest in the middle. It is striated on the surface, considerably heavy, of a deep brown colour, and somewhat bright or glossy.

glossy. It is of a very penetrating smell, not disagreeable, and of a hot, acrid, and bitterish taste. Caraway seed is to be chosen large, new, and of a good colour, not dusty, and of an agreeable smell. The plant which produces the caraway seed grows wild in the meadows of *France* and *Italy*, and in many other places; but is sown in fields for the sake of the seeds in *Germany*, and many other parts of *Europe*.

Recipe for making Ten Gallons of Caraway Cordial.

Take of caraway seeds bruised, three pounds; proof spirit, twelve gallons; water, two gallons; draw off ten gallons, or till the feints begin to rise; make the goods up with clean water, and dulcify with common sugar to your taste. Or,

Take of caraway seed bruised, two pounds and an half; orange or lemon peel dried, one pound; proof spirit, twelve gallons; water, two gallons; draw off, and dulcify as before.

Caraway cordial, like that of aniseed, is a good carminative; but not so much used, though much more pleasant.

WORMWOOD CORDIAL.

There are two sorts of wormwood cordial, distinguished by the epithets of *greater* and *lesser*.

Recipe for making Ten Gallons of the lesser Composition of Wormwood Cordial.

Take of the leaves of dried wormwood, five pounds; of the lesser cardamom seeds, five ounces; of coriander seeds, one pound; of clean

 proof

proof spirit, eleven gallons; water, one gallon; draw off ten gallons, or till the feints begin to rise, with a gentle fire. It may be dulcified with sugar, or not, at pleasure.

This is a good stomachic and carminative; and on that account often called for.

Recipe for Ten Gallons of the greater Composition of Wormwood Cordial.

Take of the common and sea wormwood, dried, of each ten pounds; of sage, mint, and balm, dried, of each twenty handfuls; of the roots of galangal, ginger, calamus aromaticus, and coriander, of each three ounces; of cinnamon, cloves, and nutmegs, the lesser cardamoms and cubebs, of each two ounces. Cut and bruise the ingredients as they require; digest them twenty-four hours, in eleven gallons of fine proof spirit, and two gallons of water, and draw off ten gallons, or till the feints begin to rise, with a pretty brisk fire.

This is an excellent composition, and good in all diseases of the stomach, arising either from wind or a bad digestion. It is greatly in use in many parts of *England,* but comes too dear for the common sort of people; on which account a cordial is often sold under the title of *the greater composition of wormwood cordial,* drawn from the leaves of wormwood, orange and lemon peel, calamus aromaticus, pimento, and the seeds of anise and caraway; which being all cheap ingredients, the composition may be sold at a moderate price. A water drawn in this manner is a good carminative; but far inferior to that made by the above recipe. It is necessary to observe here, that it is only the odour and flavour which reside in the essential oil of the wormwood that comes over with the spirit, as bitters do not rise in distillation.

PEPPERMINT CORDIAL.

Peppermint has a more penetrating smell than any of the other mints, and a much warmer, pungent, glowing taste, like pepper, sinking as it were into the tongue; it seems to act as soon as taken, and extends its effects through the whole system, instantly communicating a glowing warmth.

Recipe for Ten Gallons of Peppermint Cordial.

Take of dry peppermint leaves, four pounds; proof spirit, ten gallons and an half; water, one gallon; draw off ten gallons by a gentle fire. You may either dulcify it or not. It is most commonly dulcified.

Peppermint cordial is a noble stomachic, good against vomiting, nauseas, cholic, and other griping pains in the bowels; in all which intentions it greatly exceeds the common spearmint water. Sweeten with coarse sugar to your palate.

OF MAKING COMPOUNDS OR CORDIALS.

The perfection of this grand branch of distillery depends upon the observation of the following general rules, easy to be observed and practised.

1. The artist must always be careful to use a well cleansed spirit, or one freed from its own essential oil, as were before observed. For as a compound cordial is nothing more than a spirit impregnated with the essential oil of the ingredients, it is necessary that the spirit should have deposited its own.

2. Let

2. Let the time of previous digestion be proportioned to the tenacity of the ingredients, or the ponderosity of their oil. Thus cloves and cinnamon require a longer digestion before they are distilled than calamus aromaticus, or orange-peel. Sometimes cohobation (as subsequently explained) is necessary; for instance, in making the strong cinnamon cordial; because the essential oil of cinnamon is so extremely ponderous, that it is difficult to bring it over the helm with the spirit without cohobation.

3. Let the strength of the fire be proportioned to the ponderosity of the oil intended to be raised with the spirit. Thus, for instance, the strong cinnamon cordial requires a much greater degree of fire than that from lax vegetables, as mint, balm, &c.

4. Let only a due proportion of the finest parts of the essential oil be united with the spirit; the grosser and less fragrant parts of the oil not giving the spirit so agreeable a flavour, and at the same time renders it thick and unsightly. This may in a great measure be effected by leaving out the feints, and making up to proof with fine soft water in their stead.

These four rules, carefully observed, will render this extensive part of distillation far more perfect than it is at present. Nor will there be any occasion for the use of burnt allum, white of eggs, isinglass, &c. to fine down cordials; for they will presently be fine, sweet, and pleasant tasted, without any farther trouble.

STRONG CINNAMON CORDIAL.

Cinnamon is a very useful and elegant aromatic bark, of a fragrant delightful smell, and sweet pungent taste, with some degree of astringency; it corroborates the *viscera*, and proves of great service in all kinds

kinds of alvine fluxes, and immoderate discharges from the *uterus*; it is cordial and stomachic.

Recipe for Sixteen Gallons of Strong Cinnamon Cordial.

Take eight pounds of fine cinnamon, bruised; seventeen gallons of clean rectified spirit; and two gallons of water. Put them into your still, and digest them twenty-four hours with a gentle heat; after which draw off sixteen gallons by a pretty strong heat.

I have ordered a much larger quantity of cinnamon than is common among distillers; because, when made in the manner above directed, it is justly looked upon as one of the noblest cordials of the shops; but when made in the common way of two pounds to twenty gallons of spirit, as some have ordered, is only an imposition on the buyer. Some also, to render the goods cheaper, use equal quantities of cinnamon and *cassia lignea*; but by this means the cordial is rendered much worse; and, therefore, if you desire a fine cinnamon-cordial the above recipe will answer your intention; but if a cheaper sort be desired, you may lessen the quantity of cinnamon, and add *cassia lignea* in its stead. If you would dulcify your cinnamon cordial, take double-refined sugar, what quantity you please; the general proportion is about two pounds to a gallon, and dissolve it in the spirit after you have made it up proof with clean water. One general caution is here necessary to be added, namely, that near the end of the operation you carefully watch the spirit as it runs into the receiver, in order to prevent the feints mixing with the goods. This you may discover by often catching some of it as it runs from the worm in a glass, and observing whether it is fine and transparent; for as soon as the feints begin to rise, the spirit will have an azure, or bluish cast. As soon, therefore, as you perceive this alteration, change the receiver immediately; for if you suffer the feints to mix with your other goods, the value of the whole will be greatly lessened.

With

With regard to the feints, they are to be kept by themselves, and poured into the still when a fresh supply of the same goods is to be made.

It is also necessary to observe here, once for all, that the distillers call all goods made up proof, *double goods;* and those which are below proof, *single.* This observation will be alone sufficient to instruct the young distiller, how he may at any time turn his proof or double goods into single.

HUNGARY WATER.

Rosemary, the principal ingredient in Hungary water, has always been a favourite shrub in medicine; it is full of volatile parts, as appears by its taste and smell. It is a very valuable cephalic, and is good in all disorders of the nerves; in hysteric and hypochondriac cases, in palsies, apoplexies and vertigoes. Some suppose that the flowers possess the virtues of the whole plant in a more exalted degree than any other part; but the flowery tops, leaves, and husks, together with the flowers themselves, are much fitter for all purposes, than the flowers alone.

Recipe for Ten gallons of Hungary Water.

Take of the flowery tops, with the leaves and flowers of rosemary, fourteen pounds; rectified spirit, eleven gallons and an half; water, one gallon; distil off ten gallons with a moderate fire. If you perform this operation in *balneum mariæ,* your Hungary water will be much finer than if drawn by the common alembic.

This is called Hungary water, from its being first made for a princess of that kingdom. Some add lavender flowers, and others

Florentine

Florentine orice-root; but what is most esteemed is made with rosemary only.

LAVENDER WATER.

There are two sorts of lavender water, the simple and compound; the first is much used externally on account of its fragrancy, and cephalic virtues; the latter internally in a great number of disorders.

Recipe for Ten Gallons of Simple Lavender Water.

Take fourteen pounds of lavender flowers, ten gallons and a half of rectified spirit of wine, and one gallon of water; draw off ten gallons with a gentle fire; or, which is much better, in *balneum mariæ.*

Both the Hungary and lavender water may be made at any time of the year without distillation, by mixing the oil of the plant with highly rectified spirit of wine. In order to this, when the plant is in perfection, you should distil a large quantity of it in water, with a very brisk fire; placing under the nose of the worm the separating glass (as before described) by which means you will obtain the essential oil of the plant, in which both its fragrancy and virtue reside. Having procured the essential oil of the plant, the water may readily be made in the following manner: put the rectified spirit into a receiver, and let an assistant shake it with a quick motion: whilst the spirit is thus agitated, drop in leisurely the essential oil, and it will mix without any foulness or milkiness.

The oils of lavender and rosemary are imported cheaper from abroad than they can be made here; but these oils will not mix with the spirit, without rendering it foul and milky; and, therefore, if you

propose making Hungary or lavender water in this manner, it will be necessary to extract the oil yourself.

Recipe for making Three Gallons of Compound Lavender Water.

Take of lavender water above described, two gallons, of Hungary water one gallon, cinnamon and nutmegs of each three ounces, and of red saunders one ounce; digest the whole three days in a gentle heat, and then filter it for use. Some add saffron, musk, and ambergris, of each half a scruple; but these are now generally omitted.

This compound lavender water has been long celebrated in all nervous cases. In all kinds of palsies, and loss of memory, it is of the greatest service; and has been so much remarked for its efficacy in these complaints, as almost universally to obtain the name of *Palsy Drops*.

CARDAMON SEED CORDIAL.

The seed from whence this cordial takes its name, is called by botanists *Cardamum Minus*, or the lesser cardamom; to distinguish it from the *Cardamomum Majus*, or grains of paradise.

The lesser cardamom is a small short fruit, or membranous capsule, of a triagonal form, about a third of an inch long, and swelling out thick about the middle; beginning small and narrow from the stalk, and terminating in a small but obtuse point at the end. It is striated all over very deeply with longitudinal furrows, and consists of a thin but very tough membrane, of a fibrous texture, and pale-brown colour, with a faint cast of red. When the fruit is thoroughly ripe, this membrane opens at the three edges all the way, and shews that it is internally divided by three thin membranes, into three cells, in

in each of which is an arrangement of seeds, separately lodged in two serries. The seeds are of an irregular angular figure, rough, and of a dusky brown colour on the surface, with a mixture of yellowish and redish, and of white colour within. They have not much smell, unless first bruised, when they are much like camphire under the nose. They arc of an acrid, aromatic, and fiery hot taste. They should be chosen sound, close shut on all sides, and full of seeds of a good smell and of an acrid aromatic taste.

Recipe for Ten Gallons of Cardamom Seed Cordial.

Take of the lesser cardamom seeds husked two pounds and a half, of clean proof spirit ten gallons and a half, and of water one gallon; draw off ten gallons by a gentle heat. You may either dulcify it or not with fine sugar at pleasure.

This water is carminative, assists digestion, and is good to strengthen the head and stomach. A tincture or infusion is still better.

JAMAICA PEPPER WATER.

Jamaica pepper, or pimento, is the fruit of a tall tree growing in the mountainous parts of *Jamaica*, where it is much cultivated, because of the great profit arising from the cured fruit, sent in large quantities annually into *Europe*.

It is gathered, when green, and exposed to the sun for many days on cloths, and frequently shook and turned, till thoroughly dry; great care is taken during the time of drying to defend the fruit from the morning and evening dews; when thoroughly dried it is sent over to us.

It is a very noble aromatic, and deserves to be used more frequently than it is at present. The simple water drawn from it is a better carminative than any other simple water at present in use.

Recipe for a Gallon of Jamaica Pepper Cordial.

Take of *Jamaica* pepper half a pound, water two gallons and half; draw off one gallon with a pretty brisk fire. The oil of this fruit is very ponderous, and therefore this water is best made in an alembic.

THE TINCTURE AND ESSENCE OF AMBERGRIS, MUSK, AND CIVET.

1. Authors have been long divided with regard to the origin of ambergris; some taking it for a vegetable juice, which either dropped into the water from the trunks or branches of some trees growing on the sea-coast, or exudated from their roots which ran out of the earth into the sea; some for an animal production, and formed either by a secret process from honey-combs, or the dung of birds; and others have very circumstantially recorded that it is produced in the whale. These opinions are, however, now looked upon as false; ambergris being universally allowed to be a mineral production, of the number of bitumens. It is a light and frothy substance, which generally bubbles up out of the earth in a fluid form, principally under water, where it is by degrees hardened into the masses we see it in.

Ambergris, in its natural or common form, is a lax and coarse substance of an irregular structure, friable, and so light as to swim upon water. It is of a pale grey colour, with a faint tinge of brown in it; but pieces perfectly and uniformly of this colour are rare; what we usually meet with is composed of whitish, yellowish, and blackish granules; and in proportion as there is more of less or this whitish matter

matter in these masses, it is more or less scented and valuable. It is found in pieces of perfectly irregular figures, and from the bigness of a pea to those of ten, twenty, or more pounds; nay, there have been masses found of more than two hundred weight.

It should be chosen in clean and not over friable pieces, of a pale grey colour, and as uniform as possible in its structure, with small black specks within.

There are two sorts of essences made from this perfume; one without addition of any other odoriferous substance, and the other from ambergris compounded with musk and civet.

Recipe for making the Essence of Ambergris.

Take of ambergris and white sugar-candy, of each three drachms; grind them well together in a glass mortar, adding to them by slow degrees, five ounces of rectified spirit of wine; digest the whole in a matrass, (represented *fig.* 8.) well stopped, for four days, and then separate the clear tincture or essence, which keep in a bottle well stopt for use.

Recipe for making the Compound Essence of Ambergris.

Take of ambergris and white sugar-candy, of each two drachms; musk, twelve grains; grind all these well together in a glass mortar, adding, by degrees, four ounces of rectified spirit of wine; digest and separate the clear essence for use, as in the preceding recipe.

2, Musk is a dry, light, and friable substance, of a dark blackish colour, with some tinge of a purplish or blood colour in it. It is soft, and somewhat smooth and unctuous to the touch, and of a highly perfumed smell. It is brought to us sewed up in a kind of bladders,

or

or cases of skin, covered with a brownish hair, which are the real bags in which the musk is lodged while on the animal. Musk should be chosen of a very strong scent, and in dry sound bladders; and must be kept close shut down in a leaden box, by which means it will retain its smell, and not grow too dry.

Recipe for making the Essence of Musk.

Take of musk and white sugar-candy, of each one drachm; rub them well together in a marble mortar, adding, by degrees, during the rubbing, five ounces of rectified spirit of wine; put the whole into a matrass; digest three days in a gentle heat, and pour off the clear essence, which keep in a bottle well stopped for use. Some add a few grains of civit to their essence of musk, which considerably augments the fineness of the perfume.

3. Civet is produced like musk, in bags growing to the lower part of the belly of an animal. It is of different colours, from a pure lively whitish to a black; but the nearer it approaches to the white the better it is; of an extremely strong smell, and a bitterish pungent taste.

The essence of civet is rarely used alone, but of great service in making additions to other odoriferous waters, and therefore I shall here give the method of making it.

Recipe for making the Essence of Civet.

Take of civet and double-refined sugar, of each two drachms; rub them well together in a glass mortar; adding, by degrees, five ounces of rectified spirit of wine; put the whole into a matrass, digest three days in a gentle heat, and pour off the clear essence for use. Though the essences are, properly speaking, chemical preparations,

tions, and therefore might be foreign to the business of the distiller, yet, as they are often added to perfumed waters, and easily made, I thought the foregoing recipes would not be unacceptable to the reader.

CITRON CORDIAL.

The citron is an agreeable fruit resembling a lemon in colour, smell, and taste. The inside is white, fleshy and thick, containing but a small quantity of pulp, in proportion to the bigness of the fruit.

Recipe for making Ten Gallons of Citron Cordial.

Take of dry yellow rinds of citron four pounds, clean proof spirit ten gallons and an half, water one gallon; digest the whole twenty-four hours with a gentle heat; draw off ten gallons with a gentle fire; or, which is much better, in *balneum mariæ,* and dulcify it with fine sugar to your palate. Or,

Take of dry yellow rinds of citrons three pounds, of orange peel two pounds, nutmegs bruised three quarters of a pound; digest, draw off, and dulcify as before.

This is one of the most pleasant cordials we have; and the addition of the nutmegs, in the second receipt, increases its virtue as a cephalic and stomachic. Instead of nutmegs, some substitute half a pound of Jamaica pepper, and use but half a pound of orange-peel. Citron cordial of our shops, is usually made with lemon, instead of citron peel: even so, with the above addition of the Jamaica pepper instead of the nutmegs, it proves a fine aromatic, cephalic, and stomachic cordial: inferior to few that is made.

OF FEINTS, AND THE USES THEY MAY BE APPLIED TO.

In many of the preceding recipes I have ordered the receiver to be removed as soon as the feints begin to rise; because otherwise the goods would contract a disagreeable taste and smell. It is not, however, to be understood that these are feints to be thrown away, nor the working of the still immediately stopped; for they are far from being of no value, notwithstanding they would be of great disadvantage if suffered to run among the more spirituous parts of the goods before drawn off. As soon, therefore, as you find the clear colour of the goods begins to change of a bluish or whitish colour, remove the receiver, place another under the nose of the worm, and continue the distillation as long as the liquor running from the worm is spirituous, which may be known by pouring a little of it on the still-head, and applying a lighted candle to it; for if it is spirituous it will burn, but otherwise, not. When the feints will no longer burn on the still-head, put out the fire, and pour the feints into a cask for that purpose; and when, from repeated distillations, you have procured a sufficient quantity of these feints, let the still be charged with them almost to the top; then throw into the still three or four pounds of salt, and draw off as you would any other charge, as long as the spirit extracted is of sufficient strength; after which the receiver is to be removed, and the feints saved by themselves, as before.

The spirits thus extracted from the feints will serve in several compositions as well as fresh; but they are generally used in aniseed cordials, because the predominant taste of the aniseeds will entirely cover that they had before acquired from other ingredients.

EAU DE LUCE.

Recipe for Two Gallons.

Take of oil of amber, one ounce; of highly rectified spirit of wine, four pounds. Put them into a bottle, and let them remain there five days, shaking the bottle from time to time, by which means the spirit will be strongly impregnated with the oil; then put into this impregnated spirit four ounces of the choicest amber, finely powdered, and let it digest three days, by which means you will have a very rich tincture of amber, which decant clear for use.

The tincture of amber being thus made, take of the strongest spirit of sal amoniac, sixteen pounds, and add it to the foregoing tincture, together with eight pounds of highly rectified spirit of wine. Thus will you obtain the celebrated water called *Eau de Luce,* so greatly in request, and so useful in all faintings and lowness of spirits.

COMPOUND GENTIAN WATER.

Recipe for Five Quarts.

Gentian root, sliced, three pounds; leaves and flowers of the lesser centaury, of each eight ounces; infuse the whole in six quarts of proof spirits, and one quart of water; and draw off the water till the feints begin to rise.

This water is frequently used as a stomachic, and commended as a deterger, and of great service in dropsies, the jaundice, and any obstructions of the viscera; a glass of it being drank twice a day. As bitters do not rise in distillation, this should be made by infusion, or digestion.

 AROMATIC

AROMATIC CEPHALIC WATER.

This water has its name from its delicate smell, and great use in all swimmings and giddiness in the head.

Recipe for Two Gallons.

Nutmegs, mace, cloves, and cinnamon, of each two ounces; galangals, and calamus aromaticus, of each one drachm; flowers of lavender, three handfuls; infuse the whole in nine quarts of proof spirit; and draw off two gallons by gentle distillation.

This is an excellent composition; it makes an admirable cordial, and may be rendered more pleasant by sweetening it with sugar.

AROMATICS.

Aromatics are substances of a warm pungent taste, and a more or less fragrant smell. Some of the spices are purely aromatic, as cubebs, pepper, cloves; some substances have a sweetness mixed with the aromatic matter, as angelica-root, aniseed, fennel-seed; some an astringency, as cinnamon; some a strong mucilage, as *cassia lignea*; some a bitterness, as orange-peel. The aromatic matter itself, contained in different subjects, differs also not a little in its pharmaceutic properties. It is extracted from all by rectified spirit of wine; from some in great part, from others scarcely at all, by water. The aromatic matter of some subjects, as of lemon-peel, rises wholly in distillation, both with spirit and water; that of others, as cinnamon, rises wholly with water, but scarcely at all with spirit; while that of others, as pepper, is in part left behind, after the distillation of water itself from the spice.

With

With regard to the general virtues of aromatics, they warm the stomach, and by degrees the whole habit, raise the pulse, and quicken the circulation. In cold languid cases, phlegmatic habits, and a weak flacid state of the solids, they support the *vis vitæ*, and promote the salutary secretions. In hot bilious temperaments, plethoric habits, inflammatory indispositions, dryness and strictures of the fibres, they are generally hurtful.

BITTERS.

Gentian Root, Hops, Lesser Centaury, Carduus, &c.

Bitters for the most part yield their virtue both to watery and spirituous menstrua,; some more perfectly to one, and others to the other. None of the substances of this class give over any thing considerable of their taste in distillation, either to water or to spirit; their bitterness remaining entire, and frequently improved, in the extracts. Such as are accompanied with flavour, as wormwood, may, by this process, be reduced into simple flavourless bitters.

These substances participate of the virtues of astringents and aromatics. Their general effects are, to constringe the fibres of the stomach and intestines, to warm the habit, attenuate the bile and juices in the first passages, and promote the natural evacuations, particularly of sweat and urine. In weakness of the stomach, loss of appetite, indigestion, and the like disorders, proceeding from a laxity of the solids, or cold sluggish indisposition of the juices, these kinds of medicines do good service. Where the fibres are already too tense and rigid, where there is any immoderate heat or inflammation, bitters very sensibly increase the distemper; and if their use be continued, communicate it to the kidneys: hence the urine becomes high coloured, small in quantity, and, at length, suppressed; a dropsy soon

suceeding. If the kidneys were before so lax, as to remain now uninjured, yet the other viscera become gradually more and more rigid, and a tabes is at length brought on.

Bitter substances destroy insects, and prevent putrefaction. Hence they are recommended as anthelmintic; and externally as antiseptics.

SPIRITUOUS TINCTURES, OR INFUSIONS.

Rectified spirit of wine is the direct menstruum of the resins and essential oils of vegetables; and totally extracts these active principles from sundry vegetable matters, which yield them to water either not at all, or only in part. It dissolves likewise the sweet saccharine matter of vegetable; and generally, those parts of animal bodies, in which their peculiar smells and tastes reside.

The virtues of many vegetables are extracted almost equally by water and rectified spirit; but in the watery and spirituous tinctures of them there is this difference, that the active parts, in the watery extractions, are blended with a large proportion of inert gummy matter, on which their solubility in this menstruum in great measure depends, while rectified spirit extracts them almost pure from gum. Hence, when the spirituous tinctures are mixed with watery liquors, a part of what the spirit had taken up from the subject generally separates and subsides, on account of its having been freed from that matter which, being blended with it in the original vegetable, made it soluble in water. This however is not universal; for the active parts of some vegetables, when extracted by rectified spirit, are not precipitated by water, being almost equally dissoluble in both menstrua.

Rectified spirit may be tinged by vegetables of all colours, except blue. The leaves of plants in general, which give out but little of their

their natural colour to watery liquors, communicate to spirit the whole of their green tincture, which for the most part proves elegant, though not very durable.

Fixt alkaline salts deepen the colour of spirituous tinctures; and hence have been supposed to promote the dissolving power of the menstruum, though this does not appear from experience: in the trials that have been made to determine this affair, no more was found to be taken up in the deep-coloured tinctures, than in the paler ones, and often not so much; if the alkali be added after the extraction of the tincture, it will heighten the colour as much as when mixed with the ingredients at first. Nor is the addition of these salts, in making tinctures, useless only, but likewise prejudicial, as they, in general, injure the flavour of aromatics, and superadd a quality, sometimes contrary to the intention of the medicine. Volatile alkaline salts, in many cases, promote the action of the spirit. Acids generally weaken it; unless when the acid has been previously combined with the vinous spirit into a compound of new qualities, called dulcified spirit.

GENERAL RULES FOR EXTRACTING TINCTURES.

I. The vegetable substances ought to be moderately and newly dried, unless they are expressly ordered otherwise. They should likewise be cut and bruised, before the menstruum is poured on them.

II. If the digestion be performed in balneo, the whole success depends upon a proper management of the fire; it ought to be all along gentle, unless the hard texture of the subject should require it to be augmented; in which case the heat may be increased so as to make the menstruum boil a little towards the end of the process.

III. Very large circulatory vessels ought to be employed for this purpose, which should be heated before they are luted together.

Circulatory vessels are those which are so contrived, and of such a height, that the vapour, which arises during the digestion, may be cooled and condensed in the upper part, and fall down again into the liquor below; by these means the dissipation, both of the spirit and of the volatile parts of the ingredients, is prevented. They are generally composed of two long-necked matrasses, or bolt-heads; the mouth of one of which is to be inserted into that of the other, and the juncture secured by a piece of wet bladder. The use of heating the vessels is to expel a part of the air, which otherwise, rarifying in the process, would endanger bursting them, or blowing off the uppermost matrass. A single matrass with a long neck, or with a glass pipe inserted into its mouth, is more commodious than the double vessel.

IV. The vessel is to be frequently shaken during the digestion.

V. All tinctures should be suffered to settle before they are committed either to the filter or strainer.

VI. In the tinctures (and distilled spirits likewise) designed for internal use, no other spirit (drawn from malt, molasses, or other fermented matter) is to be used, than that expressly prescribed.

VII. Resins and resinous gums yield tinctures more successfully, if, after being ground into powder, they be mixed with some white sand, well washed and dried, which will prevent their running into lumps by the heat. If the powders prescribed be sufficient for this purpose, such an addition is unnecessary.

BITTER TINCTURE.

Take of gentian-root, two ounces; yellow rind of Seville orange-peel, dried, one ounce; lesser cardamom-seeds, freed from the husks, half an ounce; proof spirit, two pints; digest without heat, and strain off the tincture.

This is a very elegant spirituous bitter. As the preparation is designed for keeping, lemon-peel, an excellent ingredient in the watery bitter infusions, has, on account of the perishableness of its flavour, no place in this. The cardamom-seeds are here a very commodious ingredient, as in this spirituous menstruum they are free from the inconvenience with which they are attended in other liquors, of rendering them untransparent. The Edinburgh pharmacopœia has a composition similar in intention to this, under the title of

STOMACHIC ELIXIR.

Take of gentian-root, two ounces; Curassao oranges, one ounce; Virginian snake-root, half an ounce; cochineal, half a dram; French brandy, two pints. Let them steep for three days, and then filter the elixir.

This elixir differs from that of the former editions, in the substitution of Curassao oranges to fresh orange-peel, and in the addition of half an ounce of Virginian snake-root. The first is a grateful aromatic bitter, and the latter superadds a degree of pungency coinciding with the intention. Both this and the preceding composition are very useful stomachic bitters.

AROMATIC

AROMATIC TINCTURE.

Take of cinnamon, six drachms; lesser cardamom-seeds, freed from the husks, three drachms; long pepper and ginger, of each two drachms; proof spirit, two pints. Digest without heat, and then strain off the tincture.

This is a very warm aromatic, too much so to be given without dilution. A tea-spoonful or two may be taken in wine, or any other convenient vehicle, in languors, weakness of the stomach, flatulencies, and similar complaints. The stomachic tincture described hereafter, is similar in intention to this, but contrived less hot of the spices, that it may be taken by itself.

AROMATIC TINCTURE.

Take of cinnamon, six drachms; lesser cardamom-seeds, one ounce; garden angelica-root, three drachms; long pepper, two drachms; proof spirit, two pounds and an half. Macerate seven days, and filter.

This preparation is improved from the preceding editions, by the omission of some articles either superfluous or foreign to the intention; galangal, gentian, zedoary, and bayberries. As now reformed, it is a sufficiently elegant warm aromatic.

ESSENTIAL OILS.

Essential Oils are drawn by distillation in an alembic, with a large refrigeratory. A quantity of water is added to the subject, sufficient

to

to prevent its burning; and, in this water it is likewise macerated a little time before the distillation. The oil comes over along with the water; and either swims on its surface, or sinks to the bottom, according as it is lighter or heavier than that fluid.

Essential oils are obtained only from odoriferous substances; but not equally from all of this class, nor in quantity proportionable to their degree of odour; some which, if we were to reason from analogy, should seem very well fitted for this process, yielding extremely little oil, and others none at all. Roses and camomile flowers, whose strong and lasting smell promises abundance, are found, upon experiment, to contain but a small quantity. The violet and jasmine flower, which perfume the air with their odour, lose their smell upon the gentlest coction, and do not afford the least perceptible mark of oil upon being distilled, unless immense quantities be submitted to the operation at once; whilst savin, whose disagreeable scent extends to no great distance, gives out the most oil of almost any vegetable known.

Nor are the same plants equally fit for this operation, when produced in different soils or seasons; or at different times of their growth. Some yield more oil if gathered when the flowers begin to fall off, than at any other time; lavender and rue for instance. Others, as sage, afford the largest quantity when young, before they have sent forth any flowers; and others, as thyme, when the flowers have just appeared. All fragrant herbs yield a larger proportion of oil when produced in dry soils and warm summers, than in the opposite circumstances. On the other hand, some of the disagreable strong-scented ones, as wormwood, are said to contain most in rainy seasons, and moist rich grounds.

Several of the chemists have been of opinion, that herbs and flowers, moderately dried, yield a greater quantity of essential oil,

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than if they were distilled when fresh. It is supposed, that the oil being already blended, in fresh plants, with a watery fluid, great part of it remains diffused through the water after the distillation, divided into particles too minute to unite and be collected; whereas, in drying, the oily parts, on the exhalation of the moisture which kept them divided and dispersed, run together into globules, which have little disposition to mingle with watery fluids, and easily separate from the water employed in the distillation.

This theory, however, does not appear to be altogether satisfactory; for though the oil be collected in the subject into disinct globules, it does not rise in that form, but resolved into vapour, and blended and coagitated by the heat with the vapour of the water; and if the oil in a dry plant were less disposed to unite with aqueous fluids than in a fresh one, the dry ought to yield a weaker infusion than the fresh; the contrary of which is generally found to obtain. As the oil of the dry plant is most perfectly extracted, and kept dissolved by the water before the distillation, I can see no reason why it should have a greater tendency to separate from the water afterwards.

The opinion of dry plants yielding most oil, seems to have arisen from an observation of Hoffman, which has, I think, been misunderstood: " A pound," he says, " of dry spike flowers yields an ounce of " oil; but if they were distilled fresh, they would scarcely yield above " half an ounce; and the case is the same in balm, sage, &c. The " reason is, that in drying, the watery humidity exhales; and as from " two pounds of a fresh plant we do not obtain above one pound of " dry, and little of the subtile oil evaporates in the drying, it follows, " that more oil ought to be afforded by the dry than by the fresh." The meaning of which I apprehend to be no more than this: that if two pounds of a fresh plant be, by drying, reduced to one, without any loss of the oil, then the one pound dry ought to be equivalent to the two fresh. A later writer quotes an experiment of Neumann, which

which appears to be misunderstood in the same manner; for Neumann, in the place referred to, says only, that dry wormwood is found to yield much more oil than an *equal weight* of the fresh plant. I do not recollect any instance, in which fresh and dry plants have been brought to a fair comparison, by dividing the quantity of the subject into two equal weights, and distilling one, while fresh, and the other, after it has been carefully and moderately dried.

But whatever may be the effect of moderate exsiccation, it is certain, that if the drying be long continued, the produce of oil will be diminished, its colour altered, and its smell impaired.

With regard to the proportion of water, if whole plants, moderately dried, be used, or the shavings of woods, as much of either may be put into the vessel, as, lightly pressed, will occupy half its cavity; and as much water may be added, as will rise up to two-thirds its height. The water and ingredients, altogether, should never take up more than three-fourths of the still; there should be liquor enough to prevent any danger of an empyreuma, but not so much as to be too apt to boil over into the receiver.

The maceration should be continued so long, as that the water may fully penetrate the parts of the subject. To promote this effect, woods should be thinly shaved across the grain, roots cut transversely into thin slices, barks reduced into coarse powder, and seeds lightly bruised. Very compact and tenacious substances require the maceration to be continued a week or two, or longer; for those of a softer and looser texture, two or three days are sufficient; whilst some tender herbs and flowers not only stand not in need of any at all, but are even injured by it.

Whether the addition of sea salt be of any real service, is greatly to be doubted. The uses generally assigned to it are, to penetrate and

 unlock

unlock the texture of the subject more effectually than simple water could do; and to prevent the fermentation or putrefaction, into which the matter is apt to run during the length of time that the maceration is often continued. But sea salt seems rather to harden and condense, than to soften and resolve, both vegetable and animal subjects; and if it prevent putrefaction, it must, on that very account, be rather injurious than of service. The resolution here aimed at, approaches near to a beginning putrefaction; and saline substances, by retarding this, prolong the maceration far beyond the time that would otherwise be necessary. It is in the power of the operator, when he perceives the process coming near this pitch, to put a stop to it at pleasure, by proceeding immediately to distillation. By these means, the whole affair will be finished in a very little time, with at least equal advantage in every other respect; provided the manual operations of pounding, rasping, and the like, which are equally necessary in either case, be scientifically complied with.

Bodies of a very viscous and compact texture, are directed, in the Edinburgh pharmacopœia, to be fermented for some days with a little yeast: half their quantity of water is sufficient for performing the fermentation; so much more as is necessary, is to be added afterwards, before the distillation. This process undoubtedly promotes the resolution of the subject, and the extrication of the oil; it rarely happens, however, that assistances of this kind are needful. Particular care must be had not to continue the fermentation too long; or to give a bad flavour to the oil by an ill-chosen ferment, or using too large a quantity of any.

Some chemists pretend, that by the addition of salts and acid spirits, they have been enabled to gain more oil from certain vegetable matters, than can possibly be got from them without such assistance. Experiments made on purpose to settle this point seem to prove the contrary. This at least is constantly found to be true; that where there

there is any reason to think the yield to be greater than usual, the quality of the oil is proportionably injured. The quantity of true essential oil in vegetables can by on means be increased; and what is, really contained in them may be easily separated without any addition of this kind. All that saline] matters can do in this respect, is, to make the water susceptible of a greater degree of heat than it can sustain by itself, and thus enable it to carry up a gross unctuous matter, not volatile enough to arise with pure water. This gross matter, mingling with the pure oil, increases the quantity, but at the same time must necessarily debase its quality. And indeed, when water alone is made use of, the oil which comes over about the end of the operation is remarkably less fragrant, and of a thicker consistence, than that which arises at the beginning; distilled a second time, with a gentle heat, it leaves a large quantity of gross, almost insipid, resinous matter behind.

The choice of proper instruments is of great consequence to the performance of this process to advantage. There are some oils, which pass freely over the swan-neck of the head of the common still: others, less volatile, cannot easily be made to rise so high. For obtaining these last, we would recommend a large low head, having a rim or hollow canal round it. In this canal the oil is detained on its first ascent (and thence conveyed at once into the receiver) the advantages of which are sufficiently obvious.

With regard to the fire, the operator ought to be expeditious in raising it at first, and to keep it up, during the whole process, of such a degree, that the oil may freely distil; otherwise, the oil will be exposed to an unnecessary heat, a circumstance which ought as much as possible to be avoided. Fire communicates to all these oils a disagreeable impression, as is evident from their being much less grateful when newly distilled, than after they have stood for some time in a

cool

cool place; the longer the heat is continued, the more alteration it must produce in them.

The greater number of oils require for their distillation the heat of water strongly boiling; but there are many also which rise with a considerable less heat: such as those of lemon-peel, citron-peel, oils of the flowers of lavender and rosemary, and of almost all the more odoriferous kinds of flowers. We have already observed, that these flowers have their fragrance greatly injured, or even destroyed, by beating or bruising them. It is impaired also by the immersion in water, in the present process; and the more so in proportion to the continuance of the immersion, and the heat. Hence these oils, distilled in the common manner, prove much less agreeable in smell than the subjects themselves. For the distillation of substances of this class, I have contrived another method. Instead of being immersed in water, they are exposed only to its vapour. A proper quantity of water being put into the bottom of the still, the odoriferous herbs or flowers are laid lightly in a basket, of such a size that it may enter into the still, and rest against its sides, just above the water. The head being then fitted on, and the water made to boil, the steam, percolating through the subject, imbibes the oil, without impairing its fragrance, and carries it over into the receiver. Oils thus obtained, possess the odour of the subject in an exquisite degree, and have nothing of the disagreeable scent perceivable in those distilled by boiling them in water in the common manner.

It may be proper to observe, that those oils, which rise with a less heat than that of boiling water, are generally called by the chemical and pharmaceutical writers, *light oils;* and those which require the heat of water strongly boiling, are called *ponderous.* I have avoided these expressions, as they might be thought to relate to the comparitive *gravities* of the oils; with which the volatility, or fixedness, have no connection. Oil olive is lighter than most of the essential

oils;

oils; but the heat requisite to make it distil exceeds that in which the heaviest essential oil distils, considerably more than the heat of boiling water exceeds that of ice.

The water employed in the distillation of essential oils always imbibes some portion of the oil; as is evident from the smell, taste, and colour which it acquires. It cannot, however, retain above a certain quantity; and therefore such as has been already used, and almost saturated itself, may be advantageously employed instead of common water, in a second, third, or any future distillation of the same subject.

Some late chemical writers recommend, not the water which comes over, but that which remains in the still, to be used a second time. This can be of no service; as containing only such parts of the vegetable as are not capable of arising in distillation, and which serve only to impede the action of the water as a menstruum, and endanger an empyreuma.

After the distillation of one oil, particular care should be had to duly cleanse the worm before it is employed in the distillation of a different plant. Some oils, those of wormwood and aniseeds for instance, adhere to it so tenaciously, as not to be melted out by heat, or washed off by water. The best way of cleansing the worm from these, is to run a little spirit of wine through it.

Essential oils, after they are distilled, should be suffered to stand for some days, in vessels loosely covered with paper, till they have lost their disagreeable fiery odour, and become limpid: then put them up in small bottles, which are to be kept quite full, closely stopped, in a cool place. With these cautions, they will retain their virtues in perfection for many years.

When

When carelessly kept, they in time gradually lose their flavour, and become gross and thick. Some endeavour to recover them again, after they have undergone this change, by grinding them with about thrice their weight of common salt, then adding a large proportion of water, and distilling them afresh. The purer part arises thin and limpid, possessing a great degree of the prestine smell and taste of the oil, though inferior in both respects to what the oil was at first. This rectification, as it is called, succeeds equally without the salt. The oils, when thus altered, are nearly in the same state with the turpentine, and other thickened oily juices, which readily yield their purer oil in distillation with water alone.

When essential oils have entirely lost their smell, some recommend adding them in the distillation of a fresh quantity of the oil of the same plant; by which means they are said to satiate themselves anew with the odorous matter, and become entirely renovated. This practice, however, ought doubtless to be disapproved, as being no other than a specious sophistication; for it can do no more than to divide, between the old oil and the new, the active matter which belongs to the new alone.

Essential oils, medicinally considered, agree in the general qualities of pungency and heat; in particular virtues, they differ as much as the subjects from which they are obtained, the oil being the direct principle in which the virtues, or part of the virtues, of the several subjects reside. Thus the carminative virtue of the warm seeds, the diuretic of juniper-berries, the emmenagogue of savin, the nervine of rosemary, the stomachic of mint, the antiscorbutic of scurvy-grass, the cordial of aromatics, &c. are concentrated in their oils.

There is another remarkable difference in essential oils, the foundation of which is less obvious; that of the degree of their pungency and heat; which are by no means in proportion, as might be expected,

to

to those of the subject they were drawn from. The oil of cinnamon, for instance, is excessively pungent and fiery ; in its undiluted state, it is almost caustic; whereas cloves, a spice which in substance is far more pungent than the other, yields an oil which is far less so. This difference seems to depend partly upon the quantity of oil afforded, cinnamon yielding much less than cloves, and consequently having its active matter concentrated into a smaller volume; partly, upon a difference in the nature of the active parts themselves; for though essential oils contain always the specific odour and flavour of their subjects, whether grateful or ungrateful, they do not always contain the whole pungency; this resides frequently in a more fixed resinous matter, and does not rise with the oil. After the distillation of cloves, pepper, and some other spices, a part of their pungency is found to remain behind; a simple tincture of them in rectified spirit of wine is even more pungent than their pure essential oils.

The more grateful oils are frequently made use of for reconciling to the stomach medicines of themselves disgustful. It has been customary to employ them as correctors for the resinous purgatives; an use to which they do not seem to be well adapted. All the service they can here be of, is to make the resin sit easier at first on the stomach : far from abating the irritating quality upon which the virulence of its operation depends, these pungent oils superadd a fresh stimulus. See the article Cathartics.

Essential oils are never given alone, on account of their extreme heat and pungency ; which in some is so great, that a single drop, let fall upon the tongue, produces a gangrenous eschar. They are readily imbibed by pure dry sugar, and in this form may be conveniently exhibited. Ground with eight or ten times their weight of the sugar, they become soluble in aqueous liquors, and thus may be diluted to any assigned degree. Mucilages also render them miscible with water into an uniform milky liquor. They dissolve likewise in spirit

of wine; the more fragrant in an equal weight, and almost all of them in less than four times their own quantity. These solutions may be either taken on sugar, or mixed with syrups, or the like: on mixing them with water, the liquor grows milky, and the oil separates.

The more pungent oils are employed externally against paralytic complaints, numbness, pains and aches, cold tumours, and in other cases where particular parts require to be heated or stimulated. The tooth-ach is sometimes relieved by a drop of these almost caustic oils, received on cotton, and cautiously introduced into the hollow tooth.

ESSENTIAL OIL OF THE LEAVES OF WORMWOOD.

This is one of the more ungrateful oils; it smells strongly of the wormwood, and contains its particular nauseous taste; but has little or nothing of its bitterness, this remaining entire in the decoction left after the distillation. Its colour, when drawn from the fresh herb, is a dark green; from the dry, a brownish yellow. This oil is recommended by Hoffman as a mild anodyne, in spasmodic contractions: for this purpose, he directs a drachm of it to be dissolved in an ounce of rectified spirit of wine, and seven or eight drops of the mixture taken for a dose in any convenient vehicle. Boerhaave greatly commends it, in tertian fevers, a medicated liquor composed of about seven grains of the oil, ground first with a drachm of sugar, then with two drachms of the salt of wormwood, and afterwards dissolved in six ounces of the distilled water of the same plant. Two hours before the fit is expected, the patient is to bathe his feet and legs in warm water, and then to drink two ounces of the liquor every quarter of an hour till the two hours are expired. By these means, he says, all cases of this kind are generally cured with ease and safety, provided there is no schirrosity or suppuration. With us, the oil or wormwood is employed

ployed chiefly as a vermifuge, and for this purpose is both applied externally to the belly, and taken internally. It is most conveniently exhibited in the form of pills, which it may be reduced into by mixing it with crumb of bread.

ESSENTIAL OIL OF DILL SEEDS.

This is a very warm oil; of a flavour not very agreeable, less so than that of the seeds. It is sometimes given as a carminative, in flatulencies, colicky pains, hiccups, and the like, from one to three or four drops.

ESSENTIAL OIL OF ANISEEDS.

This oil possesses the taste and smell of the aniseeds in perfection. It is one of the mildest of the distilled oils. Fifteen or twenty drops may be taken at a time without danger, though common practice rarely goes so far as half this number. Its smell is extremely durable and diffusive. Milk drawn from the breast, after taking it, is found impregnated with its odour; and possibly this may be, in part, the foundation of the pectoral virtues usually ascribed to it. In flatulencies and colics it is said by some to be less effectual than the seeds themselves.

It is remarkable of this oil, that it congeals, even when the air is not sensibly cold, into a butyraceous consistence: and hence, in the distillation of it, the operator ought not to be over solicitous in keeping the water in the refrigeratory too cool: it behoves him rather to let it grow somewhat hot, particularly towards the end of the process; otherwise the oil congealing, may so stop up the worm, as to

 endanger

endanger blowing off the head of the still; at least a considerable quantity of oil will remain in it.

ESSENTIAL OIL OF CARAWAY SEEDS.

The flavour of this exactly resembles that of the caraway. It is a very hot and pungent oil; a single drop is a moderate dose, and five or six a very large one. It is not unfrequently made use of as a carminative; and supposed by some to be peculiarly serviceable for promoting urine, to which it communicates some degree of its smell.

ESSENTIAL OIL OF JUNIPER BERRIES.

This oil is a very warm and pungent one, of a strong flavour, not unlike that of the berries. In the dose of a drop or two, it proves a serviceable carminative and stomachic. In one of six, eight, or more, a stimulating, detergent, diuretic, and emmenagogue. It seems to have somewhat of the nature of the turpentines, or their distilled oil; like which it communicates a violet smell to the urine.

The oil of these berries resides partly in vesicles spread through the substance of the fruit, and partly in little cells contained in the seeds; when the berry is dry, and the oil hardened into a resinous substance, it becomes visible, upon breaking the seeds, in form of little transparent drops. In order therefore to obtain this oil to advantage, we ought, previously to the distillation, to bruise the berry thoroughly; so as to break the seeds, and entirely lay open the oily receptacles.

ESSENTIAL

ESSENTIAL OIL OF LAVENDER FLOWERS.

This oil, when in perfection, is very limpid, of a pleasant yellowish colour, extremely fragrant, possessing in an eminent degree the peculiar smell generally admired in the flowers. It is a medicine of great use, both externally and internally, in paralytic and lethargic complaints, rheumatic pains, and debilities of the nervous system. The dose is from one drop to five or six.

Lavender flowers yield the most fragrant oil, and in considerably the largest quantity, when they are ready to fall off spontaneously, and the seeds begin to shew themselves; the leaves give out extremely little. The flowers may be separated from the rest of the plant by drying it a little, and then gently beating it; they should be immediately committed to distillation, and the process conducted with a well-regulated gentle heat; too great heat would not only change the colour of the oil, but likewise make a disagreeable alteration in its smell.

ESSENCE OF LEMONS, OR THE ESSENTIAL OIL OF LEMON-PEEL.

This is a pleasant oil, of a fine smell, very near as agreeable as that of the fresh peel; it is one of the lightest and most volatile essential oils we have, perfectly limpid, and almost colourless. It is taken in doses of two or three drops, as a cordial, in weakness of the stomach, &c. though more frequently used as a perfume. It gives a fine flavour to the officinal *spiritus volatilis aromaticus*, and occasions the soap pills to sit easy on the stomach.

By similar means all the essential oils in use may be obtained; therefore they need not be enumerated here.

Most of the oils are drawn by our chemists, and easily procurable in a tolerable degree of perfection; those of cinnamon, cloves, nutmegs, and mace, excepted. These are usually imported; and are for the most part so much adulterated, that it is difficult to meet with such as are at all fit for use.

Nor are the adulterations of these kinds of preparations easily discoverable. The grosser abuses indeed may be readily detected: thus if the oil be mixed with spirit of wine, it will turn milky on the addition of water; if with expressed oils, rectified spirit will dissolve the essential, and leave the other behind; if with oil of turpentine, on dipping a piece of paper in the mixture, and drying it with a gentle heat, the turpentine will be betrayed by the smell. But the more subtle artists have contrived other methods of sophistication, which elude all trials of this kind.

Some have looked upon the specific gravity of oils as a certain criterion of their genuineness; and we have therefore given a table of the gravity of several in a subsequent page. This, however, is not to be absolutely depended on; for the genuine oils, obtained from the same subjects, oftentimes differ in gravity as much as those drawn from different ones. Cinnamon and cloves, whose oils usually sink in water, yield, if slowly and warily distilled, an oil of great fragrancy, which is nevertheless specifically lighter than the aqueous fluid employed in the distillation of it; whilst, on the other hand, the last runnings of some of the lighter oils prove sometimes so ponderous as to sink in water.

As all essential oils agree in the general properties of solubility in spirit of wine, indissolubility in water, miscibility with water by the

the intervention of certain intermedia, volatility in the heat of boiling water, &c. it is plain, that they may be variously mixed with one another, or the dearer sophisticated with the cheaper, without any possibility of discovering the abuse by any trials of this kind. And indeed it would not be of much advantage to the purchaser, if he had infallible criteria of the genuineness of every individual oil. It is of as much importance, that they be *good*, as that they be *genuine*; for I have often seen genuine oils, from incurious distillation, and long and careless keeping, weaker both in smell and taste than the common sophisticated ones.

The smell and taste seem to be the only certain tests that the nature of the thing will admit of. If a bark should have in every respect the appearance of good cinnamon, and should be proved indisputably to be the genuine bark of the cinnamon-tree; yet, if it want the cinnamon flavour, or have it but in a low degree, we reject it; and the case is the same with the oil. It is only from use and habit, or comparisons with specimens of known quality, that we can judge of the goodness, either of the drugs themselves, or of their oils.

Most of the essential oils, indeed, are too hot and pungent to be tasted with safety; and the smell of the subject is so much concentrated in them, that a small variation in this respect is not easily distinguished. But we can readily dilute them to any assignable degree. A drop of the oil may be dissolved in spirit of wine; or received on a bit of sugar, and dissolved by that intermedium in water. The quantity of liquor which it thus impregnates with its flavour, or the degree of flavour which it communicates to a certain determinate quantity, will be the measure of the degree of goodness of the oil.

I shall here subjoin some experiments, *of the quantity of essential oil obtained from different vegetables*, reduced into the form of a table.

The

The first column contains the names of the respective vegetable substances, the second the quantity of each which was submitted to the distillation, and the third the quantity of oil obtained. In every other part of this book, where *pound* weights are mentioned, the troy pound of twelve ounces is meant: but these experiments having been all made by a pound of sixteen ounces, it was thought expedient to set down the matter of fact in the original weights; especially as the several materials, in the large quantity commonly required for the distillation of oils, are purchased by weights of the same kind. But to remove any ambiguity which might arise hence, and enable the reader to judge more readily of the yield, a reduction of the weights is given in the next column; which shews the number of parts of each of the subjects, from which one part of oil was obtained. To each article is affixed the author's name from whom the experiment is taken: those to which no name is added, are experiments of my own. The different distillations of one subject, several of which are inserted in the table, shew how variable the yield of oil is, and that the exotic spices, as well as our indigenous plants, do not always contain the same proportion of this active principle: though it must be observed, also, that part of the differences may probably arise from the operation itself having been more or less carefully performed.

TABLE

TABLE OF THE QUANTITY OF ESSENTIAL OIL OBTAINED FROM DIFFERENT VEGETABLES.

		yielded of essential oil	so that one part of oil was obtained from	
Agallocum-wood	10 lb.	4 dra.	320	*Hoff.*
Angelica-root	1 lb.	1 dra.	128	*Carth.*
Aniseed	1 lb.	4 dra.	32	*Neum.*
Aniseed	3 lb.	1 oz.	48	
Aniseed	4 lb.	1 oz.	64	
Asafœtida	4 oz.	1 dra.	32	*Neum.*
Calamus aromaticus	50 lb.	2 oz.	185	*Hoff.*
Calamus aromaticus	1 lb.	2 scrup.	192	*Neum.*
Caraway-seeds	4 lb.	2 oz.	32	
Caraway-seeds	2 lb.	9 dra.	28½	
Caraway-seeds	1 cwt.	83 oz.	21½	
Carline thistle-root	1 lb.	2½ scrup.	153	*Neum.*
Cardamom-seeds	1 oz.	1 scrup.	24	*Neum.*
Carrot-seeds	2 lb.	1½ dra.	171	
Cascarilla	1 lb.	1 dra.	128	*Carth.*
Camomile-flowers	1 lb.	30 gra.	256	*Carth.*
Common camomile-flowers	6 lb.	5 dra.	153	
Wild camomile-flowers	1 lb.	20 gra.	384	*Carth.*
Wild camomile-flowers	6 lb.	2½ dra.	307	
Chervil-leaves, fresh	9 lb.	30 gra.	2304	*Neum.*
Cedar-wood	1 lb.	2 dra.	64	*Margg.*
Cinnamon	1 lb.	1 dra.	128	*Sala.*
Cinnamon	1 lb.	2⅞ scrup.	153	*Neum.*
Cinnamon	4 lb.	6 dra.	85⅓	*Lemery*
Cinnamon	1 lb.	2 dra.	64	*Carth.*
Cinnamon	1 lb.	8 scrup.	45½	*Carth.*
Clary-seeds	4 lb.	2 dra.	256	
Clary in flower, fresh	130 lb.	3½ oz.	594	
Cloves	1 lb.	1½ oz.	10⅓	*Teichm.*
Cloves	1 lb.	2¼ oz.	7⅔	*Carth.*
Cloves	2 lb.	5 oz.	6⅔	*Hoff.*
Copaiba balsam	1 lb.	6 oz.	2⅔	*Hoff.*
Copaiba balsam	1 lb.	8 oz.	2	
Cummin-seed	1 bush.	21 oz.	...	
Dictamnus Creticus	1 lb.	30 gra.	256	
Dill-seed	4 lb.	2 oz.	32	
Elecampane-root	2 lb.	3½ scrup.	245	*Neum.*
Elemi	1 lb.	1 oz.	16	*Neum.*
Fennel-seed, common	2 oz.	1 scrup.	48	*Neum.*
Fennel-seed, sweet	1 bush.	18 oz.	...	
Galingal-root	1 lb.	1 dra.	128	*Carth.*
Garlick-root, fresh	2 lb.	30 gra.	256	*Neum.*
Ginger	1 lb.	1 dra.	128	*Neum.*
Horseradish-root, fresh	8 oz.	15 gra.	256	*Neum.*

Hyssop-

Hyssop-leaves	2	lb.	yielded of essential oil	1½	dra.	so that one part of oil was obtained from	237	*Neum.*
Hyssop-leaves	1	lb.		½	dra.		85	*Carth.*
Hyssop-leaves	1	lb.		2	dra.		64	*Carth.*
Hyssop-leaves, fresh	2	cwt.		6	oz.		597	
Hyssop-leaves, fresh	10	lb.		3	dra.		427	
Hyssop-leaves, fresh	30	lb.		9	dra.		427	
Juniper-berries	8	lb.		3	oz.		42⅔	*Hoff.*
Juniper-berries	1	lb.		3	dra.		42	*Carth.*
Lavender in flower, fresh	48	lb.		12	oz.		64	
Lavender in flower, fresh	30	lb.		6¼	oz.		72	
Lavender in flower, fresh	13½	cwt.		60	oz.		403	
Lavender flowers, fresh	2	lb.		4	dra.		64	*Hoff.*
Lavender-flowers, dried	4	lb.		2	oz.		32	
Lavender-flowers, dried	2	lb.		1	oz.		32	*Hoff.*
Lavender-flowers, dried	4	lb.		3	oz.		21⅓	*Hoff.*
Broad-leaved Lavender-flowers dry	4	lb.		1	oz.		64	*Hoff.*
	1	lb.		2	dra.		64	*Carth.*
Lovage-root	1	lb.		1	dra.		128	*Carth.*
Mace	1	lb.		5	dra.		25⅔	*Neum.*
Mace	1	lb.		6	dra.		21⅓	*Carth.*
Marjoram in flower, fresh	81	lb.		3¾	oz.		347	
Marjoram in flower, fresh	13½	lb.		3½	dra.		493	
Marjoram in flower, fresh	34	lb.		1½	oz.		362	
Marjoram-leaves, fresh	18½	lb.		4	dra.		592	
Marjoram-leaves, dried	4	lb.		1	oz.		64	*Hoff.*
Masterwort-root	1	lb.		30	gra.		256	*Neum.*
Milfoil-flowers, dried	14	lb.		4	dra.		448	
Mint in flower, fresh	6	lb.		4½	dra.		177	
Mint-leaves, dried	4	lb.		1½	oz.		42⅔	*Hoff.*
Peppermint, fresh	4	lb.		3	dra.		170⅔	
Myrrh	1	lb.		2	dra.		64	*Hoff.*
Myrrh	1	lb.		3	dra.		42⅔	*Neum.*
Nutmegs	1	lb.		1	oz.		16	*Hoff.*
Nutmegs	1	lb.		1	oz.		16	*Geoff.*
Nutmegs	1	lb.		4	dra.		32	*Neum.*
Nutmegs	1	lb.		6	dra.		21⅓	*Sala.*
Nutmegs	1	lb.		5	dra.		25⅔	*Carth.*
Parsley-seeds	2	lb.		1	dra.		256	
Parsley-leaves, fresh	238	lb.		2	oz.		1904	
Parsnip-seeds	8	lb.		2	dra.		512	
Pennyroyal in flower, fresh	13	lb.		6	dra.		277	
Black-pepper	2	lb.		6	dra.		42⅔	
Black-pepper	1	lb.		2½	dra.		82	*Neum.*
Black-pepper	1	lb.		4	scrup.		96	*Carth.*
Black-pepper	1	lb.		1	dra.		128	*Heister*
Black-pepper	6	lb.		3	dra.		256	*Geoff.*
Pimento	1	oz.		30	gra.		16	*Neum.*
Rhodium-wood	1	lb.		3	dra.		42⅔	*Neum.*
Rhodium-wood	1	lb.		2	dra.		64	*Sala.*
Rhodium-wood	1	lb.		3	dra.		42⅔	*Sala.*
Rhodium-wood	1	lb.		3	dra.		42⅔	*Carth.*
Rhodium-wood	1	lb.		4	dra.		132	*Carth.*

Rosemary

Rosemary in flower	1	cwt.	yielded of essential oil	8	oz.	so that one part of oil was obtained from	224	
Rosemary-leaves	1	lb.		2	dra.		64	*Sala.*
Rosemary-leaves	1	lb.		3	dra.		$42\frac{2}{3}$	*Sala.*
Rosemary-leaves	3	lb.		10	gra.		121	*Neum.*
Rosemary-leaves	1	lb.		1	dra.		128	*Carth.*
Rosemary-leaves	1	lb.		$1\frac{1}{2}$	dra.		82	*Carth.*
Rosemary-leaves, fresh	70	lb.		5	oz.		224	
Roses	100	lb.		4	dra.		3200	*Taochen.*
Roses	100	lb.		1	oz.		1600	*Homb.*
Roses	12	lb.		30	gra.		768	*Hoff.*
Rue	10	lb.		2	dra.		640	*Hoff.*
Rue	10	lb.		4	dra.		320	*Hoff.*
Rue in flower	4	lb.		1	dra.		512	
Rue in flower	60	lb.		$2\frac{1}{4}$	oz.		507	
Rue with the seeds	72	lb.		3	oz.		384	
Saffron	1	lb.		$1\frac{1}{2}$	dra.		$85\frac{1}{3}$	*Vogel*
Sage-leaves	1	lb.		5	scrup.		77	*Carth.*
Sage in flower, fresh	34	lb.		$1\frac{1}{2}$	oz.		544	
Sage of virtue in flower	27	lb.		6	dra.		576	
Sage of virtue in flower	8	lb.		$1\frac{1}{2}$	dra.		681	
Sassafras	6	lb.		$1\frac{3}{4}$	oz.		55	*Hoff.*
Sassafras	6	lb.		2	oz.		48	*Neum.*
Savin	2	lb.		5	oz.		$6\frac{2}{5}$	*Hoff.*
Saunders, yellow	1	lb.		2	dra.		64	*Carth.*
Smallag-seeds	1	lb.		$2\frac{1}{2}$	scrup.		154	*Neum.*
Stechas in flower, fresh	$5\frac{3}{4}$	lb.		2	dra.		368	
Thyme in flower, fresh	2	cwt.		$5\frac{1}{2}$	oz.		652	
Thyme in flower, dry	$3\frac{1}{2}$	lb.		$1\frac{1}{2}$	dra.		298	
Lemon-thyme in flower, fresh	51	lb.		$1\frac{3}{4}$	oz.		653	
Lemon-thyme in flower, fresh	98	lb.		$2\frac{1}{2}$	oz.		627	
Lemon-thyme, dried a little	104	lb.		3	oz.		555	
Wormwood-leaves, dry	4	lb.		1	oz.		64	
Wormwood-leaves, dry	18	lb.		$1\frac{1}{2}$	oz.		192	
Wormwood-leaves, dry	25	lb.		$3\frac{1}{2}$	oz.		114	
Zedoary	1	lb.		1	dra.		128	*Neum.*

SPIRITUOUS DISTILLED WATERS, &c.

The flavour and virtues of distilled waters are owing, as before observed, to their being impregnated with a portion of the essential oil of the subject from which they are drawn. Spirit of wine, considered as a vehicle for these oils, has this advantage above water, that it is their proper menstruum, and keeps all the oil that rises with it perfectly dissolved into an uniform limpid liquor.

Nevertheless, many substances, which, on being distilled with water, impart to it their virtues in great perfection, if treated in the same manner with spirit of wine, scarce give over to it any smell or taste. This difference proceeds hence; that spirit is not susceptible of so great a degree of heat as water. Liquids in general, when made to boil, have received as great a heat as they are capable of sustaining: now, if the extent of heat between freezing and boiling water, as measured by thermometers, be taken for a standard, spirit of wine will be found to boil with less than four-fifths of that heat, or above one-fifth less than the heat of boiling water. It is obvious therefore, that substances may be volatile enough to rise with the heat of boiling water, but not of that of boiling spirit.

Thus if cinnamon, for instance, be committed to distillation with a mixture of spirit of wine and water, or with a pure proof spirit, which is no other than a mixture of about equal parts of the two; the spirit will arise first, clear, colourless, and transparent, and almost without any taste of the spice; but as soon as the more ponderous watery fluid begins to arise, the oil comes freely over with it, so as to render the liquor highly odorous, sapid, and of a milky hue.

The proof spirits usually met with in the shops are accompanied with a degree of ill-flavour; which, though concealed by means of certain

certain additions, plainly discovers itself in distillation. This nauseous relish does not begin to arise till after the purer spirituous part has come over; which is the very time that the virtues of the ingredients begin, also, most plentifully to distil; and hence the liquor receives an ungrateful taint. To this cause principally is owing the general complaint, that the cordials of the apothecary are less agreeable than those of the same kind prepared by the distiller; the latter being extremely curious in rectifying or purifying the spirits (when designed for what he calls fine goods) from all ill flavour.

RECTIFIED SPIRIT OF WINE.

Take any quantity of French brandy, and with a gentle heat distil it to one-half.

This rectified spirit, being digested for two days with one-fourth its quantity of dry salt of tartar in powder, and then distilled in a glass cucurbit, with a very gentle heat, becomes *alcohol.*

Spirits distilled from malt-liquors, or other fermented substances, after being rectified in the above method, require further purification; namely, repeated distillation from an equal quantity of spring water.

French brandy is rather too dear an article in this country for distillation; nor is the spirit obtained from it any ways preferable to one procurable from cheaper liquors. The coarser inflammable spirits may be rendered perfectly pure, and fit for the nicest purposes, by the following method:

If the spirit be exceedingly foul, mix it with about an equal quantity of water, and distil with a slow fire; discontinuing the operation as soon as the liquor begins to run milky, and discovers, by its nauseous

ous taste, that the impure and phlegmatic part is arising. By this treatment, the spirit leaves a considerable portion of its foul oily matter behind it in the water, which now appears milky and turbid, and proves highly disagreeable in taste. If the spirit was not very foul at first, this ablution is not necessary; if extremely so, it will be needful to repeat it once, twice, or oftener.

As vinous spirits arise with a less degree of fire than watery liquors, we are hence directed to employ, in the distillation of them, a heat less than that in which water boils; and if due regard be had to this circumstance, very weak spirits may, by one or two wary distillations, be tollerably well freed from their aqueous phlegm; especially if the distilling vessels be of such a height, that the spirit, by the heat of a water-bath, may but just pass over them. In such case, the phlegmatic vapours which arise for a little way along with the spirit, will condense and fall back again before they can come to the head. Very pompous instruments have been contrived for this purpose, and carried in a spiral or serpentine form to an extraordinary height. The spirit, ascending through these, was to leave all the watery parts it contained in its passage, and come over perfectly pure and free from phlegm. But these instruments are built upon erroneous principles, their extravagant height defeating the end it was designed to answer. If the liquor be made to boil, a considerable quantity of mere phlegm will come over along with the spirit; and if the heat be not raised to this pitch, neither phlegm nor spirit will distil. The most convenient instrument is the common still, betwixt the body of which and its head an adopter, or copper tube, may be fixed.

The spirit being washed, as above directed, from its foul oil, and freed from the greatest part of the phlegm, by gentle distillation in a water bath; add to every gallon of it, a pound or two of pure, dry, fixed alkaline salt. Upon digesting these together for a little time, the alkali, from its known property of attracting water and oils, will imbibe

imbibe the remaining phlegm, and such part of the disagreeable unctuous matter as may still be left in the spirit, and sink with them to the bottom of the vessel. If the spirit be now again gently drawn over, it will arise entirely free from its phlegm and nauseous flavour; but some particles of the alkaline salt are apt to be carried up with it, and give what the workmen call an urinous relish. This may be prevented by adding, previously to the last distillation, a small proportion of calcined vitriol, alum, or *sal catharticus amarus;* the acid of these salts will unite with, and neutralize the alkali, and effectually prevent it from arising; while no more of the acid of the salts is extricated than what the alkali absorbs.

The spirit obtained by these means is extremely pure, limpid, perfectly flavourless, and fit for the finest purposes. It may be reduced to the strength commonly understood by proof, by mixing twenty ounces of it (by weight) with seventeen ounces of water. The distilled cordials made with these spirits, prove much more elegant and agreeable, than when the common rectified or proof spirits of the shops are made use of.

If the rectified spirit be distilled afresh from dry alkaline salt, with a quick fire, it brings over a considerable quantity of the salt, and in this state is supposed to be a more powerful menstruum, for certain substances, than the pure spirit. This alkalized spirit is called *tartarized spirit of wine.*

The general virtues of vinous spirits have been already mentioned in the preceding part. The spirits impregnated with the volatile oils of vegetables, to be presently treated of, have joined to those, the aromatic, cordial, or other virtues which reside in the oils.

N. B. The most convenient mode of advantageously performing this operation is, by putting a pound of common salt, well decrepitated,

pitated, to every two gallons of spirit, at one to two over proof, suspended in a bag, in the still, during the operation, which will gradually dissolve, attract the water from the spirit, and prevent its rising. By this means the greatest part of the spirit will come over a strong alcohol. Towards the latter end of the operation, a little of the distilling spirits must be received in a silver table-spoon, and set on fire, to try whether it will explode gun-powder. The instant it ceases to produce this effect, the receiver must be removed; and the operation continued as long as it runs proof; and when it ceases to do so, the vessel must be again changed, to receive the feints.

COMPOUND BALM WATER, COMMONLY CALLED EAU DE CARMES.

Take of balm in flower, fresh gathered and clear from the stalks, two pounds; lemon-peel, fresh, as soon as pared from the fruit, four ounces; coriander seeds, eight ounces; nutmegs, cloves, cinnamon, each, bruised, two ounces; angelica roots, dried and bruised, one ounce; spirit of wine, highly rectified, ten pints. Steep the several ingredients in the spirit four or five days; and then draw off, in the heat of a water-bath, ten pints. Rectify the distilled liquor by a second distillation in a water-bath, drawing off only about eight pints and three quarters.

This process is taken from the *Elemens de Pharmacie* of M. Beaume, who observes, that all the aromatic spirits ought to be prepared in the same manner. When the common spirits of this kind are rubbed on the hands, &c. they leave, after the more volatile parts have exhaled, a disagreeable empyreumatic smell; and when diluted with water, and taken medicinally, they leave in like manner a nauseous flavour in the mouth. To remedy these imperfections, he made many experiments, which shewed, that in order to obtain these liquors of the desirable qualities,

qualities, the spirit must not only be perfectly pure at first, but that the liquor ought also to be rectified after it has been distilled from the subjects. In this rectification, only the more volatile, subtile, and aromatic parts of the ingredients arise. There remains behind a white liquor, acrid, bitter, loaded only with the grosser oil, and deprived of all the specific flavour of the subjects. Indeed the very imperfection complained of naturally points out this second distillation for the remedy; as it shews the spirit to contain a grateful and ungrateful matter, the former of which exhales, while the other is left behind. The author says, that when the *aqua melissæ* is prepared, as above directed, it has something in it more perfect than any of the odoriferous spirits whose excellence is cried up, and which have the reputation of being the best.

Aromatic spirituous waters have in general less smell when newly distilled than after they have been kept about six months. M. Beaume suspects that the preparations of this kind, which have been most in vogue, were such as had been thus improved by keeping; and found that the good effects of age might be produced in a short time by means of cold. He plunges quart bottles of the liquor into a mixture of pounded ice and sea-salt. The spirit, after having suffered for six or eight hours the cold hence resulting, proves as grateful as that which has been kept for several years. Simple waters also, after being frozen, prove far more agreeable than they were before, though they are always less so than those which have been drawn with spirit, and exposed to a like degree of cold. This melioration of distilled waters by frost was taken notice of by Geoffroy, *Hist. Acad.* 1713.

SIMPLE DISTILLED WATERS.

The effluvia which exhale in the air from many vegetables, particularly from those of the odorous kind, consist apparently of principles

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of great subtilty and activity, capable of strongly and suddenly affecting the brain and nervous system, especially in those whose nerves are of great sensibility; and likewise of operating, in a slower manner, upon the system of grosser vessels. Thus Boerhaave observes, that in hysterical and hypochondriacal persons, the fragrant odour of the Indian hyacinth excites strange spasms, which the strong scent of rue relieves; that the effluvia of the walnut-tree occasion head-achs, and make the body costive; that those of poppies procure sleep; and that the smell of bean-blossoms, long continued, disorders the senses. Lemery relates, from his own knowledge, that several persons were purged by staying long in a room where damask roses were drying.

Some of the chemists have indulged themselves in the pleasing survey of these presiding spirits, as they are called, of vegetables; their peculiar nature in the different species of plants; their exhalation into the atmosphere by the sun's heat, and dispersion by winds; their rendering the air of particular places medicinal, or otherwise, according to the nature of the plants that abound. They have contrived also different means for collecting these fugitive emanations, and concentrating and condensing them into a liquid form; employing either the native moisture of the subject, or an addition of water, as a vehicle or matrix for retaining them.

The process which has been judged most analagous to that of nature, is the following: The subject fresh gathered, at the season of its greatest vigour, with the morning dew upon it, is laid lightly and unbruised in a shallow vessel, to which is adapted a low head with a recipient. Under the vessel a live coal is placed, and occasionally renewed, so as to keep up an uniform heat, no greater than that which obtains in the atmosphere in summer, *viz.* about eighty-five degrees of Fahrenheit's thermometer. In this degree of heat there arises, very slowly, an invisible vapour, which condenses in the head into dewy

drops,

drops, and falls down into the receiver, and which has been supposed to be the very substance that the plant would have spontaneously emitted in the open air.

But on submitting to this process many kinds of odoriferous vegetables, I have always found the liquors obtained by it to be very different from the natural effluvia of the respective subjects: they had very little smell, and no remarkable taste. It appeared that a heat, equal to that of the atmosphere, is incapable of raising in close vessels those parts of vegetables which they emit in the open air. It may therefere be presumed, that, in this last case, some other cause concurs to the effect: that it is not the sun's heat alone which raises and impregnates the air with the odorous principles of vegetables, but that the air itself, or the watery humidity with which it abounds, acting as a true dissolvent, extracts and imbibes them; so that the natural effluvia of a plant may be looked upon as an infusion of the plant made in air. The purgative virtue of the damask rose, and the astringency of the walnut-tree, which, as above observed, are in some measure communicated to the air, may be totally extracted by infusion both in watery and spirituous menstrua, but never rise in distillation with any degree of heat; and the volatile odours of aromatic herbs, which are diffused through the atmosphere in the lowest warmth, cannot be made to distil without a heat much greater than is ever found to obtain in a shaded air.

The above process, therefore, and the theory on which it is built, appear to be faulty in two points; first, in supposing that all those principles, which naturally exhale from vegetables, may be collected by distillation; whereas there are many which the air extracts in virtue of its dissolving power, and which are artificially separable also by dissolvents only: secondly, in employing a degree of heat insufficient for separating even those parts which are truly exhalable by heat.

 The

The foregoing method of distillation is commonly called *distillation by the cold still;* but those who have practised it, have generally employed a considerable heat. A shallow leaden vessel is filled with the fresh herbs, flowers, &c. which are heaped above it, so that when the head is fitted on, this also may be filled a considerable way. A little fire is made under the vessel, sufficient to make the bottom much hotter than the hand can bear, care being taken only not to heat it so far as to endanger scorching any part of the subject. If the bottom of the vessel be not made so hot as to have this effect on the part contiguous to it, it is not to be feared that the heat communicated to the rest of the included matter will be great enough to do it any injury. By this management, the volatile parts of several odorous plants, as mint, are effectually forced over; and if the process have been skillfully managed, the distilled liquor proves richly impregnated with the native odour and flavour of the subject, without having received any kind of disagreeable impression from the heat made use of.

This process has been chiefly practised in private families; the slowness of the distillation, and the attendance and care necessary for preventing the scorching of some part of the plant, so as to communicate an ungrateful burnt flavour to the liquor, rendering it inconsistent with the dispatch requisite in the larger way of business.

Another method has therefore been used, that by the common still, called, in distinction from the foregoing, the hot still. Here a quantity of water is added to the plant, to prevent its burning; and the liquor is kept nearly of a boiling heat, or made fully to boil, so that the vapour rises plentifully into the head, and passing thence into a spiral pipe, or worm, placed in a vessel of cold water, is there condensed, and runs out in drops quickly succeeding one another, or in a continued stream. The additional water does not at all weaken the produce; for the most volatile parts of the subject rise first, and impreg-

nate

nate the liquor that first distils; as soon as the plant has given over its virtue sufficiently, which is known by examining from time to time the liquor that runs from the nose of the worm, the distillation is to be stopped.

This is the method of distillation commonly practised for the officinal waters. It is accompanied with one imperfection, affecting chiefly those waters whose principal value consists in the delicacy of their flavour; this being not a little injured by the boiling heat usually employed, and by the agitation of the odorous particles of the subject with the water. Sometimes also a part of the plant sticks to the sides of the still, and is so far scorched as to give an ungrateful taint to the liquor.

There is another method of managing this operation, which I have already recommended for the distillation of the more volatile essential oils, and which is equally applicable to that of the waters. In this method, the advantages of the foregoing ones are united, and their inconveniencies obviated. A quantity of water being poured into the still, and the herbs or flowers placed in a basket over it, there can be no possibility of burning; the water may be made to boil, but so as not to rise up into the basket, which would defeat the intention of this contrivance. The hot vapour of the water passing lightly through all the interstices of the basket and subject, imbibes and carries over the volatile parts unaltered in their native flavour. By these means the distilled waters of all those substances, whose oils are of the more volatile kind, are obtained in the utmost perfection, and with sufficient dispatch; for which last intention the still may be filled quite up to the head.

In the distillation of essential oils, the water, as observed in the foregoing section, imbibes always a part of the oil. The distilled liquors, here treated of, are no other than water thus impregnated with the essential

oil

oil of the subject; whatever smell, taste, or virtue, is here communicated to water, or obtained in the form of a watery liquor, being found in a concentrated state in the oil. The essential oil, or some part of it, more attenuated and subtilized than the rest, is the direct principle, on which the title of *spiritus rector*, or presiding spirit, has been bestowed.

All those vegetables therefore which contain an essential oil, will give over some virtue to water by distillation: but the degree of the impregnatian of the water, or the quantity of water which a plant is capable of satiating with its virtue, are by no means in proportion to the quantity of its oil. The oil satiates only the water that comes over at the same time with it. If there be more oil than is sufficient for this satiation, the surplus separates, and concretes in its proper form, not miscible with the water that arises afterwards. Some odoriferous flowers, whose oil is in so little quantity that scarcely any visible mark of it appears, unless fifty or an hundred pounds or more are distilled at once, give nevertheless as strong an impregnation to water, as those plants which abound most with oil.

Many have been of opinion, that distilled waters may be more and more impregnated with the virtues of the subject, and their strength increased to any assigned degree, by *cohobation;* that is, by re-distilling them a number of times from fresh parcels of the plant. Experience, however, shews the contrary; a water skilfully drawn in the first distillation, proves on every repeated one, not stronger, but more disagreeable. Aqueous liquors are not capable of imbibing above a certain quantity of the volatile oil of vegetables, and this they may be made to take up by one, as well as by any number of distillations. The oftener the process is repeated, the ungrateful impression which they generally receive from the fire even at the first time, becomes greater and greater. Those plants which do not yield at first water

sufficiently

sufficiently strong, are not proper subjects for this process, since their virtue may be obtained much more advantageously by others..

GENERAL RULES FOR THE DISTILLATION OF THE OFFICINAL SIMPLE WATERS.

1. Plants and their parts ought to be fresh gathered. Where they are directed fresh, such only must be employed; but some are allowed to be used dry, as being easily procurable in this state at all times of the year, though rather more elegant waters might be obtained from them whilst green.

2. Having bruised the subjects a little, pour thereon thrice its quantity of spring water. This quantity is to be diminished or increased, according as the plants are more or less juicy than ordinary.

When fresh and juicy herbs are to be distilled, thrice their weight of water will be fully sufficient: but dry ones require a much larger quantity. In general, there should be so much water, that after all intended to be distilled has come over, there may be liquor enough left to prevent the matter from burning to the still.

3. The distillation may be performed in an alembic with a refrigeratory, the junctures being luted.

4. The distillation is to be continued as long as the water which comes over is perceived to have any smell or taste of the plant.

Plants differ so much, according to the soil and season of which they are the produce, and likewise according to their own age, that it is impossible to fix the quantity of water to be drawn from a certain weight of them, to any invariable standard. The distillation may always be

continued

continued as long as the liquor runs well-flavoured of the subject, and no longer.

If the herbs be of prime goodness, they must be taken in the weights prescribed. But when fresh ones are substituted to dry, or when the plants themselves are the produce of unfavourable seasons, and weaker than ordinary, the quantities are to be varied according to the discretion of the artist.

After the odorous water, alone intended for use, has come over, an acidulous liquor arises, which has sometimes extracted so much from the copper head of the still, as to prove emetic. To this are owing the anthelmintic virtues attributed to certain distilled waters.

5. Formerly some vegetables were slightly fermented with the addition of yeast, previously to the distillation.

The principle on which this management is founded is certainly just; for the fermentation somewhat opens and unlocks their texture, so as to make them part with more in the subsequent distillation than could be drawn over from them without some assistance of this kind. Those plants, however, which require this treatment, are not proper subjects for simple waters to be drawn from; their virtues being obtainable to better advantage by other processes.

6. If any drops of oil swim on the surface of the water, they are to be carefully taken off.

7. That the waters may keep the better, about one-twentieth part of their weight of proof spirit may be added to each, after they are distilled.

A great

A great number of distilled waters was formerly kept in the shops, and are still retained in foreign pharmacopœias. The faculty of Paris direct, in a late edition of their *Codex Medicamentarius,* no less than one hundred and twenty-five different waters, and one hundred and thirty different ingredients in one single water. Near one-half of these preparations have scarcely any virtue or flavour from the subject, and many of the others are insignificant.

The colleges of London and Edinburgh have rejected these ostentatious superfluities; and given an elegant and compendious set of waters, sufficient for answering such purposes as these kinds of preparations are applied to in practice. Distilled waters are employed chiefly as grateful dilutents, as suitable vehicles for medicines of greater efficacy, or for rendering disgustful ones more acceptable to the palate and stomach; few are depended on, in any intentions of consequence, by themselves.

SIMPLE ALEXETERIAL WATER.

Take of spearmint-leaves, fresh, a pound and an half; sea wormwood-tops, fresh, angelica-leaves, fresh, each one pound; water, as much as is sufficient to prevent an empyreuma. Draw off by distillation three gallons. Or,

Take of elder-flowers, moderately dried, two pounds; angelica-leaves, fresh gathered, one pound; water, a sufficient quantity. Distil off three gallons.

These waters are sufficiently elegant with regard to taste and smell; though few expect from them such virtues as their title seems to imply. They are used occasionally for vehicles of alexipharmic medicines, or in juleps to be drank after them, as coinciding with the inten-

tion; but in general are not supposed to be themselves of any considerable efficacy.

SIMPLE CINNAMON WATER.

Take of cinnamon, one pound; water, as much as will prevent burning. Distil off one gallon.

CINNAMON WATER WITHOUT WINE.

Take of cinnamon one pound; water, a gallon and an half. Steep them together for two days; and then distil off the water till it ceases to run milky.

This is a very grateful and useful water, possessing in an eminent degree the fragrance and aromatic virtues of the spice. Great care should be had in the choice of the cinnamon, to avoid the too common imposition of substituting cassia in its room. This latter yields a water much less agreeable than that of cinnamon, and whose flavour is manifestly empyreumatic. The two drugs may be easily distinguished from one another by the marks laid down in another part of this work.

The virtues of all these waters depend upon their containing a portion of the oil of the subject. The oil of cinnamon is very ponderous, and arises more difficultly than that of any of the other vegetable matters from which simple waters are ordered to be drawn. This observation directs us, in the distillation of this water, to make use of a quick fire and a low vessel. For the same reason, the water does not keep so well as might be wished; the ponderous oil parting from it in time, and falling to the bottom, when the liquor loses its milky hue,

hue, its fragrant smell, and aromatic taste. Some recommend a small proportion of sugar to be added, in order to keep the oil united with the water.

SIMPLE SPEARMINT WATER.

Take of spearmint-leaves, fresh, any quantity; water three times as much. Distil as long as the liquor which comes over has a considerable taste or smell of the mint. Or,

Take spearmint-leaves, dried, a pound and an half; water, as much as is sufficient to prevent burning. Draw off by distillation one gallon.

These waters smell and taste very strong of the mint; and prove, in many cases, useful stomachics. Boerhaave commends them (cohobated) as a present and incomparable remedy for strengthening a weak stomach, and curing vomiting proceeding from cold viscous phlegm, as also in lienteries.

SIMPLE PEPPERMINT WATER.

Take of peppermint-leaves, dry, a pound and an half; water, as much as will prevent an empyreuma. Draw off by distillation one gallon.

This is a very elegant and useful water. It has a warm pungent taste, exactly resembling that of the peppermint itself. A spoonful or two, taken at a time, warms the stomach, and gives great relief in cold flatulent colics. Some have substituted a plain infusion of the dried

leaves of the plant, which is not greatly different in virtue from the distilled water.

WATER OF JAMAICA PEPPER.

Take of Jamaica pepper, half a pound; water, as much as will prevent burning. Distil off one gallon.

This distilled water is a very elegant one, and has come pretty much into use. The hospitals employ it as a succedaneum to the more costly spice waters. It is, however, inferior in gratefulness to the spirituous water of the same spice.

SIMPLE PENNY-ROYAL WATER.

Take of penny-royal-leaves, dry, a pound and an half; water, as much as will prevent burning. Draw off by distillation one gallon.

WATER OF PENNY-ROYAL.

Take of penny-royal leaves, fresh, any quantity; water, three times as much. Distil as long as the water comes off well flavoured of the herb.

These waters possess, in a considerable degree, the smell, taste, and virtues of penny-royal. They are frequently taken in hysteric cases, and not without good effects.

DAMASK ROSE WATER.

Take of damask roses, fresh gathered, six pounds; water as much as will keep them from burning. Distil off a gallon of the water. Or,

Take three parts of water to one of the fresh roses; and distil as long as the water which comes over has any smell of the flowers.

This water is principally valued an acconut of its fine flavour, which approaches to that generally admired in the rose itself. The purgative virtue of the roses remains entire in the liquor left in the still, which has therefore been generally employed for making the solutive honey and syrup, instead of a decoction or infusion of fresh roses prepared on purpose: and this piece of frugality the college have now admitted. A distilled water of red roses has been sometimes called for in the shops: and supplied by that of damask roses diluted with common water. This is a very venial substitution; for the water drawn from the red rose has no quality which that of the damask rose does not possess in a far superior degree; neither the purgative virtue of the one, nor the astringency of the other, arising in distillation.

ESSENTIAL OILS, ESSENCES, AND TINCTURES, (*Continued*).

ESSENTIAL OIL OF PEPPERMINT.

This possesses the smell, taste, and virtues, of the peppermint in perfection; the colour is a pale greenish yellow. It is a medicine of great pungency and subtilty; and diffuses, almost as soon as taken, a glowing warmth through the whole system. In cholics, accompanied with

with great coldness, and in some hysteric complaints, it is of essential service. A drop or two are in general a sufficient dose.

OIL OF CINNAMON.

This valuable oil is extremely hot and pungent, of a most agreeable flavour, like that of the cinnamon itself. In cold languid cases, and debilities of the nervous system, it is one of the most immediate cordials and restoratives. The dose is one, two, or three drops; which must always be carefully diluted by the mediation of sugar, &c. for so great is the pungency of this oil, that a single drop let fall upon the tongue, undiluted, produces, as Boerhaave observes, a gangrenous eschar. In the distillation of this oil, a smart fire is required; and the low head, with a channel round it, before recommended for the distillation of the less volatile oils, is particularly necessary for this, which is one of the least volatile, and which is afforded by the spice in exceeding small quantity. The distilled water retains no small portion of the oil; but this oil being very ponderous, great part of it subsides, from the water, on standing for two or three weeks in a cool place.

ESSENTIAL OIL OF FENNEL-SEEDS.

The oil obtained from sweet fennel-seeds is much more elegant and agreeable than that of the common fennel. It is one of the mildest of these preparations. It is nearly of the same degree of warmth with that of aniseeds; to which it is likewise similar in flavour, though far more grateful. It is given from two or three drops to ten or twelve, as a carminative, in cold indispositions of the stomach; and in some kinds of coughs, for promoting expectoration.

ESSENTIAL OIL OF JAMAICA PEPPER.

This is a very elegant oil, and may be used as a succedaneum to the oils of some of the dearest spices. It is of a fine pale colour, in flavour more agreeable than the oil of cloves, and not far short of that of nutmegs. It sinks in the water, like the oils of some of the eastern spices.

ESSENTIAL OIL OF ROSEMARY.

The oil of rosemary is drawn from the plant in flower. When in perfection, it is very light and thin, pale, and almost colourless; of great fragrancy, though not quite so agreeable as the rosemary itself. It is recommended, in the dose of a few drops, in nervous and hysteric complaints. Boerhaave holds it in great esteem against epilepsies, and suppressions of the uterine purgations, occasioned by weakness and inactivity.

ESSENTIAL OIL OF ORANGE-PEEL.

The rinds of the several varieties of oranges, lemons, and citrons, yield, by a kind of expression, their essential oils almost pure, and nearly similar to those which are obtained from them by distillation. The essential oils, in which the fragrance and aromatic warmth of these fruits reside, are contained in numerous little vesicles, which may be distinguished by the naked eye, spread all over the surface of the peel. If the rind be cut in slices, and the slices separately doubled or bent in different parts, and squeezed between the fingers, the vesicles burst at the bending, and discharge the oil in a number of fine slender jets. A glass plate being set upright in a glass or porcelain

celain vessel, and the slices squeezed against the plate, the little jets unite into drops upon the plate, and trickle down into the vessel beneath. But though this process affords the true native oil, in the same state wherein it existed in the subject, unaltered by fire or other agents, it is not practicable to advantage, unless where the fruit is very plentiful, as only a small part of the oil it contains can thus be extracted or collected.

The oil is more perfectly separated by rubbing the rind upon a lump of sugar. The sugar, by the inequality of its surface, produces the effect of a rasp, in tearing open the oily vesicles: and in proportion as the vesicles are opened, the sugar imbibes the oil. When the outward part of the lump is sufficiently moistened, it is scraped off, and the operation continued on the fresh surface. The oil thus combined with the sugar, is fit for most of the uses, to which it is applied in a fluid state. Indeed the pure essential oils, obtained by distillation, are often purposely mixed with sugar, to render their use the more commodious.

JAPONIC TINCTURE.

Take of Japan earth, three ounces; cinnamon, two ounces; proof spirit, two pints. After a proper digestion, let the tincture be passed through a strainer.

A tincture of this kind, with the addition of peruvian bark, ambergris, and musk, to the ingredients above directed, was formerly kept in the shops. The tincture here received is preferable for general use. Where any other ingredients are required, tinctures of them may be occasionally mixed with this in extemporaneous prescription. The cinnamon is a very useful addition to the Japan earth, not only as it

warms

warms the stomach, &c. but likewise as it improves the roughness and astringency of the other.

TINCTURA JAPONICA.

Best English saffron, dissevered, one ounce; mace, bruised, one ounce. Infuse them in a pint of brandy, 'till the whole tincture of the saffron be extracted (which will be in seven or eight days time) then strain it through a linen cloth, and put to the strained tincture two ounces of terra japonica powdered fine; let it stand to infuse, till the tincture be wholly impregnated therewith.

TINCTURE OF GUM KINO.

Take of gum kino, two ounces; proof spirit, one pound and an half. Digest eight days, and strain off the tincture.

These tinctures are of good service in all kinds of defluxions, catarrhs, loosenesses, uterine fluors, and similar disorders, where mild astringent medicines are indicated. Two or three tea-spoonsful may be taken every now and then, in red wine, or any other proper vehicle. Their more immediate coincidence with the views of the author, and the nature of this work, may be seen in the making up brandies, and in their application as flavouring ingredients, as may be found in the sequel.

RECTIFICATION BY AGITATION, OR WITHOUT DISTILLATION.

To every piece of raw spirits received from the malt-distiller, at one to ten over proof, take two pounds of charcoal-dust; one pound of plaster of Paris, finely powdered, and previously killed; three pounds of fullers-earth, previously slacked; clean water, four gallons; mix the plaster of Paris into thick batter with part of the water; add the fullers-earth, blended with water, of the same consistence; then stir in the charcoal, finely powdered; reduce them with the remainder of the water, and let an assistant stir them well up while pouring into the spirits, and another rouse the spirits, not only while this composition is adding, but for half an hour after; repeat the rousing every hour for four or five times; at the end of each rousing, if not performed in casks that are fixtures, roll the cask a few minutes, and let it lay bung downward until the next rousing, all but the last time, when it should be set up on one end, with a cock placed near the bottom, and another a few inches below where the liquor rises to, to draw samples, every day for a few days, to compare with each other, and with samples of the same raw spirit.

When the spirit appears cleansed of the flavour of the malt or grain, in both smell and taste, draw it off, and if intended for Gin, to be made by agitation, make it up with *lime-water,* at one in six. If to make British Brandy, make up with clear well-settled water, to one in five. If intended for Rum, without distillation, make up with rice-water, to one in six, made with *conjee,* that is, rice reduced to a jelly by boiling in a close vessel; a pound of rice made into *conjee* will be sufficient for a hogshead of water.

COMPOUNDS

COMPOUNDS PREPARED WITHOUT DISTILLATION.

RUM SHRUB.

For making from One Hundred and Twenty to One Hundred and Thirty Gallons of Rum Shrub.

Take sixty-five or seventy gallons of Rum, one in eight; from seven to eight gallons of lemon-juice; from six to seven gallons of orange-juice; both fresh expressed from the fruit; orange-wine, thirty gallons; two pounds of the rhine of fresh lemon-peel; and one pound of the rhine of fresh orange-peel; both pared off as thin as it can be done, and previously steeped for a few days in the rum; one hundred suttle pounds of loaf-sugar. Fill up the cask of one hundred and twenty gallons, or one hundred and thirty gallons, with fair water, rouse them well together; if not sweet enough, sweeten to your palate; if too sweet, add more lemon-juice. Dissolve your sugar in part of the water used for making up your shrub: let it stand till fine, set up on end, with a cock near the bottom.

BRANDY SHRUB.

For making One Hundred and Thirty Gallons of Brandy Shrub.

Take from seventy-five to eighty gallons of brandy; eight to ten gallons of lemon-juice; eight gallons of orange-juice; four pounds of the thin rhine of fresh orange-peel; and two pounds of fresh lemon-peel; both pared as thin as they can be; and add them to the brandy the first thing; with four ounces of *terra-japonica*; one hundred weight of loaf or clayed sugar, dissolved in part of the water

 used

used for making up, added with the above ingredients to the brandy, &c.; fill up with fair water; set the cask on end, with a cock near the bottom, and let it stand till fine.

Shrub may be made in similar manner with British Rum or Brandy, or with a pure flavourless spirit, prepared from *molasses* or *grain*, with similar ingredients in the before mentioned proportions. The quantity can be increased or reduced at pleasure, by duly aportioning the ingredients to the quantity of spirit employed. For instance:

To make Two Gallons of Rum Shrub.

Take one gallon of rum, at one in eight; of lemon and orange juice, each one pint; one quart of orange-wine; and two pounds of loaf-sugar; one orange and lemon peel; and fill up your two gallon vessel with water, cork it up loosely, and let it stand until fine, then cork it down close.

To make Two Gallons of Brandy Shrub.

Take one gallon and a pint of brandy, one in eight; lemon and orange juice, of each a pint; four orange and two lemon peels; sugar, two pounds; compound essence of orange and lemon peel, a small tea-spoonful; make up with fair water, and let it stand till fine. Be careful in drawing it off not to shake the vessel.

TO MAKE TWENTY GALLONS OF PEPPERMINT CORDIAL.

Take thirteen gallons of rectified spirits, one in five under hydrometer proof; twelve pounds of loaf-sugar; one pint of spirit of wine, that will fire gun-powder; fifteen penny-weights, *Troy*, of oil

of

of peppermint; water, as much as will fill up the cask, which should be set up on end; after the whole being well roused, and a cock for drawing off placed in it.

To make up the above.

Powder two or three ounces of sugar in a *brass mortar*, on which pour the oil of peppermint, and beat it into a thin paste, stirring the sugar and oil with a knife, scraping what is in the pestle and mortar together, that the oil may be uniformly incorporated with the sugar; then add the spirit of wine, and blend them well together; have the remainder of your sugar ready dissolved in four or five gallons of the water to be used for making up; rummage, or rouse, the whole well together with a paddle-staff, or rouser; and lastly, fill up the cask with pure clean water; dissolve one ounce and an half of powdered alum in the making up water, boiling over the fire; and when tepid, or blood-warm, add it to fill up the cask, in which place a cock, and let it stand two or three days, in which time it will be fit for use. If the essential oil is of your own making, or such as you can depend on, it will require nothing more than agitation; see *Lavender Water*, page 129.

TO MAKE TWENTY GALLONS OF ANISEED CORDIAL.

Take fourteen gallons of spirits, one in six; a pint of spirit of wine, strong as the former; from six to eight pounds of loaf-sugar; one onuce and an half of oil of aniseed; two ounces of finely powdered alum; dissolve the sugar in one part of the water used for making up, and your alum in the remainder; and proceed as directed in the making up *Peppermint Cordial.* Aniseed cordial does not bear to be reduced much below one in five, as part of the oil will separate when too much lowered, and render the goods unsightly.

NOJAU, TWO GALLONS.

(Usually pronounced No-i-o, and corruptly written Nauyau.)

One gallon and an half of French brandy, one in five; six ounces of the best fresh prunes; two ounces of celery; three ounces of the kernels of apricots, nectarines, and peaches; and one ounce of bitter almonds; all gently bruised; essence of orange-peel, and essence of lemon-peel, of each two penny-weights, killed in the same manner as the oil of peppermint; half a pound of loaf-sugar: let the whole stand ten days or a fortnight; then draw off, and add to the clear *Nanjau* as much rose-water as will make it up to two gallons, which will be about half a gallon.

CINNAMON CORDIAL.

To make Two Gallons of Cinnamon Cordial.

Take two penny-weights of oil of *cassia-lignea,* killed as before-mentioned, with sugar and spirits of wine; a gallon and an half, at one in six; cardamom seeds, husked, an ounce; orange and lemon peel dried, of each an ounce: fine with half a pint of alum water, sweeten to your palate with loaf sugar, not exceeding two pounds, and make up two gallons measure with the water you dissolve the sugar in. This is a very cheap, and elegant cinnamon cordial; colour with burnt sugar.

FOR TWENTY GALLONS OF CARRAWAY CORDIAL.

Take an ounce and an half of oil of carraway; twenty drops of *cassia-lignea* oil, and five drops of essence of orange peel, and the

same quantity of essence of lemon; thirteen gallons of spirits, one in five; eight pounds of loaf sugar; make it up and fine it down, as directed for aniseed.

TWENTY GALLONS OF CITRON CORDIAL.

Infuse fourteen pounds of Smyrna figs, for a week, in twelve gallons of spirits, one in five; draw off, and add to the clear spirituous infusion, essence of orange, and lemon, of each an ounce, killed in a pint of spirits of wine; half a pound of dried lemon, and four ounces of orange peel; six or seven pounds of loaf sugar: make up as before, with fair water.

ONE HUNDRED AND FORTY GALLONS OF GIN, MADE WITHOUT DISTILLATION.

Take one hundred gallons of proof malt spirits, rectified by agitation; infuse two pounds and an half of the best juniper-berries for a week or ten days; then take of oil of turpentine, three ounces; oil of juniper-berries, five ounces; oil of sweet fennel-seeds, two ounces; kill these ten ounces of essential oils with some dry loaf sugar, and dissolve them in three pints of spirit of wine that will fire gunpowder: add them to the hundred gallons of spirits and juniper-berries, rousing them well up for an hour: next day make up to one in five, with lime-water, and sweeten with a quarter of an hundred of clayed sugar. Fine with eight or ten ounces of alum dissolved in two or three gallons of the making up water reserved for the purpose. These ingredients will make a hundred and forty gallons of as good English gin, as any usually made by distillation.

TO MAKE TEN GALLONS OF GIN BITTERS.

Take of the preceding gin ten gallons ; spirit of wine half a pint, in which dissolve the following essential oils with the assistance of a little well dried loaf sugar, finely powdered, *viz.* essence of lemon and orange-peel, of each an ounce ; oil of wormwood a quarter of an ounce ; orange-peel dried, one pound ; let them digest without heat for fourteen or fifteen days, then draw off for use as wanted ; taking care not to disturb the goods, by stirring the vessel they are made in. This will be a most pleasant cheap bitter, equally wholesome, and as good as many that are much dearer. This is only fit to be taken with *Gin.* The same ingredients, and rectified malt spirits, or molasses spirits, will either of them make a bitter of more general use.

IMPERIAL RATAFIA.

To make up Twenty Gallons.

In these kingdoms the most compendious way of making the best ratafia is, by taking three-quarters of a pound of the kernels of peaches, nectarines, and apricots, bruised ; three pounds of bitter almonds, bruised ; half a gallon of rectified spirit of wine, in which dissolve half an ounce of compound essence of ambergris ; twelve gallons of pure molasses spirit, one in five ; four gallons of British Frontiniac wine ; and as many gallons of rose-water as will make up the ratafia to twenty gallons ; steep the kernels and almonds for ten days, then draw off for use. This quantity will take ten pounds of loaf-sugar to sweeten it ; but as some may not like it so, it had better be sweetened by a few gallons at a time, as it may be wanted.

NECTAR,

NECTAR, A TWENTY GALLON CASK.

A pleasant cordial for those whose stomach cannot bear a stronger, particularly if taken in the morning, for gently exhilirating the spirits, and strengthening the animal functions, may be advantageously made with fifteen gallons of the *imperial ratafia,* a quarter of an ounce of cassia-oil, and an equal quantity of the oil of carraway-seeds, dissolved in half a pint of spirit of wine, and made up with orange-wine, so as to fill up the cask. Sweeten, if wanted, by adding a small lump of sugar in the glass.

LOVAGE CORDIAL, TWENTY GALLONS.

Take of the fresh roots of lovage, valerian, and celery, sliced, each one pound; of the seeds of lovage, celery, and sweet-fennel, each four ounces; of essential oil of carraway and savin, each one ounce; spirit of wine, one pint; twelve gallons of proof spirits; loaf-sugar, twelve pounds; water, a sufficient quantity to make up the cordial to twenty gallons: steep the roots and seeds in the spirits fourteen days; and kill, or dissolve, the oils in the spirit of wine, and add them to the undulcified cordial drawn off from the other ingredients; dissolve the sugar in the water for making up; fine, if necessary, with alum.

This is a warm aperient active cordial medicine, capable of promoting sweat, urine, and all the glandular secretions; it is found of great service in obstructions of the *uterus* and other *viscera,* proceeding from a laxity and weakness of the vessels, with the advantage of being likewise a good cephalic.

THE ETHEREAL VITRIOLIC LIQUOR, OR ETHER.

Take of rectified spirit of wine, oil of vitriol, of each thirty-two ounces; pour the spirit into a glass retort, that will bear the sudden heat, and pour the acid, at once, upon it; mix them gradually and cautiously together, by gently shaking the retort; and immediately distil by a sand-heat, prepared before hand for that purpose, the recipient being placed in a vessel of snow or water. The fire should be so regulated that the liquor may boil as soon as possible, and continued to boil till sixteen ounces are distilled, when the retort is to be removed.

To the distilled liquor add two drams of the stronger common caustic; and distil again, from a very high retort, with a very gentle fire, the recipient being placed as before in a refrigeratory. Continue the distillation till ten ounces are drawn off.

To the acid residuum, after the distillation, if you pour sixteen ounces of rectified spirit of wine, and repeat the distillation, more etherial liquor may be obtained; and this process may be repeated several times.

The preparation of this singular fluid has hitherto been confined to few hands; for though several processes have been published for obtaining it, the success of most of them is precarious, and some of them are accompanied with danger to the operator. Where the dulcified spirit only is the object, the method, as before directed for it, succeeds to perfection: but when it is made with a view to the other, a variation is necessary, for only a small quantity of ether can be separated from the spirit so prepared. There, the distillation is performed with an equable and gentle heat: here, the fire should be hastily raised, so as to make the liquor boil; for on this circumstance the

the produce of ether principally depends. (See a paper on this subject by Dr. Morris, in the second volume of the Medical Observations and Inquiries.)

Ether or ethereal spirit is the lightest, most volatile, and inflammable, of all known liquids. It is lighter than the most highly rectified spirit of wine, in the proportion of about seven to eight. A drop, let fall on the hand, evaporates almost in an instant, scarcely rendering the part moist. It does not mix, or only in a small quantity, with water, spirit of wine, alkaline lixivia, volatile alkaline spirits, or acids; but is a powerful dissolvent for oils, balsams, resins, and other analogous substances. It has a fragrant odour, which in consequence of the volatility of the fluid, is diffused through a large space. Its medical effects are not as yet much known, though it is not to be doubted that a fluid of so much subtilty must have considerable effects. It has often been found to give ease in violent head-achs, by being applied externally to the part, and to relieve the tooth-ach, by being laid on the afflicted jaw. It has been given also internally, with benefit, in whooping coughs, and hysterical cases, from two or three drops to five and twenty, in a glass of wine or water; which should be swallowed as quick as possible, as the ether so speedily exhales.

DULCIFIED SPIRIT OF NITRE

Take of rectified spirit of wine, three pounds; nitrous acid, one pound; pour the rectified spirit of wine into a large bolt-head, placed in a vessel of cold water, and add by degrees the acid, carefully shaking the vessel: set it in a cool place, lightly stopped, for seven days; afterwards distil the liquor in a water-bath, the receiver being placed in a vessel filled either with water or snow, as long as any spirit arises.

Here the operator must take care not to invert the order of mixing

 the

the two liquors, by pouring the vinous spirit into the acid; for if he should, a violent effervescence and heat would ensue, and the matter be dispersed in highly noxious red fumes. The most convenient and safe method of performing the mixture seems to be, to put the inflammable spirit into a large glass body with a narrow mouth, placed under a chimney, and to pour upon it the acid, by means of a glass funnel, in very small quantities at a time; shaking the vessel as soon as the effervescence ensuing upon each addition ceases, before a fresh quantity is put in. By these means, the glass will heat equally, and be prevented from breaking. During the action of the two spirits upon one another, the vessel should be lightly covered; if close stopt, it will burst: and, if left entirely open, some of the more valuable parts will exhale. Lemery directs the mixture to be made in an open vessel; by which unscientifical procedure he usually lost, as he himself observes, half his liquor: and we may presume that the remainder was not the medicine here intended.

The liquors, mixed together, should be suffered to rest for at least twelve hours, that the fumes may entirely subside, and the union be in some measure completed. The distillation should be performed with a very slow and well regulated fire; otherwise the vapour will expand with so much force as to burst the vessels. Wilson seems to have experienced the justness of this observation; and hence directs the juncture of the retort and receiver not to be luted, or but slightly. If a tubulated recipient, with its upright long pipe, be made use of, and the distillation performed with the heat of a water-bath, the vessels may be luted without any danger. This method has likewise another advantage, as it ascertains the time when the operation is finished. Examining the distilled spirit every now and then with alkaline salts, as directed before, is sufficiently troublesome: whilst in a water-bath, we may safely draw over all that will arise, for this heat will elevate no more of the acid than what is dulcified by the vinous spirit.

Dulcified

Dulcified spirit of nitre has been long held, and not undeservedly, in great esteem. It quenches thirst, promotes the natural secretions, expels flatulencies, and moderately strengthens the stomach. It may be given from twenty drops to a dram, in any convenient vehicle. Mixed with a small quantity of spirit of hartshorn, the spiritus volatilis aromaticus, or any other alkaline spirit, it proves a mild, yet efficacious, diaphoretic, and often notably diuretic; especially in some febrile cases, where such a salutary evacuation is wanted. A small proportion of this spirit, added to malt spirits, gives them a flavour approaching to that of French brandy.

DIRECTIONS FOR PURCHASERS OF A TUN OF FINE GIN.

If you think not proper to sweeten it according to the former directions, apply to your distiller, desiring him to make you a tun of fine gin, hydrometer proof, free from deception; if he refuses, there are enough will comply.

Being agreed for, you may safely buy it by weight; but this offer will doubtless be rejected, because herein the interest of the distiller would be affected.

Previous to the pipes being filled, be careful they are in good condition, clean, and well-seasoned.

At measuring, fail not to keep score with the shopman, to prevent mistakes.

When measured, (and your score agreeing with that against you) take your instrument, and be satisfied your purchase is according to agreement, *i. e.* hydrometer proof. A bill of parcels being made out, and the business complete, take a sample of each pipe, and see them

carted

carted and sent home. When unloaded, let the whole be started into a vat, ready for that purpose. The general process with distillers I have here set down; not that I mean to recommend the use of false proof, (the infusion of which is poison to the true flavour of gin) but have inserted it for information only.

PROCESS.

A tun of fine gin, strength 1 to 7, — —	252 gallons,
gives water, — — — —	36
which added together, make — —	288
The doctor is now put on, and it is farther reduced 1 to 15 below phial proof, with water, which gives — — — — — —	19
Total	307 gallons of gin.

This done, let a pound of allum be just covered with water, and dissolved by boiling; rummage the above well together, and pour in the allum, and the whole will be fine in a few hours.

To ascertain the true cost, after the business is done, supposing the price you gave for the tun of 252 gallons, at 7s. per gallon, is 88l. 4s.

Paid for 252 gallons, at 7s. per gallon — —	88	4	0
Gained by water, as clear profit, 55 gallons, at 7s.	19	5	0
	68	19	0

If 252 gallons are 68l. 19s. which reduces the above price per gallon to the small sum of 5s. 6d. from 7s. giving a clear profit of 1s. 6d. each gallon, which the rectifier will save in not selling per tun, or hydrometer proof.

DIRECTIONS

DIRECTIONS FOR PURCHASERS OF SINGLE PIPES.

As single pipes are seldom sold at hydrometer proof, the buyer must rest satisfied with having the geneva as it is manufactured. After the cask intended for its reception has been properly examined, care should be taken that the spirit is perfectly bright; without which the sale will be injured, and the liquor deprived of a valuable recommendation.

Reduced gin should never be bought by weight, because water, (which is more ponderous than spirit) being great part of its composition, there will be a loss of three gallons on a pipe; consequently, buying by measure is here most eligible.

TO PREPARE AND SWEETEN BRITISH GIN.

Get from your distiller an empty puncheon or cask, which will contain about one hundred and thirty-three gallons; then take a cask of clear rectified spirits, one hundred and twenty gallons, one in five under proof, which is the usual strength Rectifiers sell their goods at; put the hundred and twenty gallons of spirits into your empty cask.

Then take a quarter of an ounce of the oil of vitriol, half an ounce of the oil of almonds, one quarter of an ounce of the oil of turpentine, one ounce of the oil of juniper berries, get half a pint of the spirits of wine and half a pound of lump sugar. Beat or rub the above in a mortar, until the whole is well incorporated; add another half pint of the spirits of wine to the mortar. When well rubbed together, have ready prepared half a gallon of lime water, and one gallon of rose water; mix the whole in either a pail or cask, with a stick, till every particle shall be dissolved; then add to the foregoing thirty-

thirty-five pounds of sugar dissolved in about nine gallons of clear rain or Thames water, or water that has been boiled; mix the whole well together, and stir them carefully with a stick, in the hundred and thirty-three gallon cask.

To force down the same, take and boil eight ounces of allum in three quarts of water, for three quarters of an hour. Take it from the fire, and dissolve by degrees, six or seven ounces of salt of tartar. When the same is milk warm, put it into your gin, and stir it well together, as before, for five minutes, the same as you would a butt of beer newly fined. Let your cask stand as you mean to draw it. At every time you propose to sweeten again, that cask must be well washed out; and take great care never to shake your cask all the while it is drawing.

A TABLE,

A TABLE,

SHEWING THE JUST WEIGHT OF RECTIFIED SPIRIT OF WINE, BRANDY, RUM, AND PROOF SPIRITS,

From One Gallon to Sixty-three.

For the Use of this Table the Reader is requested to see Directions for purchasing Gin. *Page* 197.

	Rect. Sp. Wine.				*Rum & Brandy.*				*Proof Spirits.*			
Gal.	C.	q.	lb.	oz.	C.	q.	lb.	oz.	C.	q.	lb.	oz.
1	0	0	6	13	0	0	7	10	0	0	7	12
2	0	0	13	10	0	0	15	4	0	0	15	8
3	0	0	20	7	0	0	22	14	0	0	23	4
4	0	0	27	4	0	1	2	8	0	1	3	0
5	0	1	6	1	0	1	10	2	0	1	10	12
6	0	1	12	14	0	1	17	12	0	1	18	8
7	0	1	19	11	0	1	25	6	0	1	26	4
8	0	1	26	8	0	2	5	0	0	2	6	0
9	0	2	5	5	0	2	12	10	0	2	13	12
10	0	2	12	2	0	2	20	4	0	2	21	8
11	0	2	18	15	0	2	27	14	0	3	1	4
12	0	2	25	12	0	3	7	8	0	3	9	0
13	0	3	4	9	0	3	15	2	0	3	16	12
14	0	3	11	6	0	3	22	12	0	3	24	8
15	0	3	18	3	1	0	2	6	1	0	4	4
16	0	3	25	0	1	0	10	0	1	0	12	0
17	1	0	3	13	1	0	17	10	1	0	19	12
18	1	0	10	10	1	0	25	4	1	0	27	8
19	1	0	17	7	1	1	4	14	1	1	7	4
20	1	0	24	4	1	1	12	8	1	1	15	0
21	1	1	3	1	1	1	20	2	1	1	22	12
22	1	1	9	1	1	1	27	12	1	2	2	8
23	1	1	16	11	1	2	7	6	1	2	10	4
24	1	1	23	8	1	2	15	0	1	2	18	0

Gal.	Rect. Sp. Wine.				Rum & Brandy.				Proof Spirits.			
	C.	q.	lb.	oz.	C.	q.	lb.	oz.	C.	q.	lb.	oz.
25	1	2	2	5	1	2	22	10	1	2	25	10
26	1	2	9	2	1	3	2	4	1	3	5	8
27	1	2	15	15	1	3	9	14	1	3	13	4
28	1	2	22	12	1	3	17	8	1	3	21	0
29	1	3	1	9	1	3	25	2	2	0	0	12
30	1	3	8	6	2	0	4	12	2	0	8	8
31	1	3	15	3	2	0	12	6	2	0	16	4
32	1	3	22	0	2	0	20	0	2	0	24	0
33	2	0	0	13	2	0	27	10	2	1	3	12
34	2	0	7	10	2	1	7	4	2	1	11	8
35	2	0	14	7	2	1	14	14	2	1	19	4
36	2	0	21	4	2	1	22	8	2	1	27	0
37	2	1	0	1	2	2	2	2	2	2	6	12
38	2	1	6	14	2	2	9	12	2	2	14	8
39	2	1	13	11	2	2	17	6	2	2	22	4
40	2	1	20	8	2	2	25	0	2	3	2	0
41	2	1	27	5	2	3	4	10	2	3	9	12
42	2	2	6	2	2	3	12	4	2	3	17	8
43	2	2	12	15	2	3	19	14	2	3	25	4
44	2	2	19	12	3	3	27	8	3	0	5	0
45	2	2	26	9	3	0	7	2	3	0	12	12
46	2	3	5	6	3	0	14	12	3	0	20	8
47	2	3	12	3	3	0	22	6	3	1	0	4
48	2	3	19	0	3	1	2	0	3	1	8	0
49	2	3	25	13	3	1	9	10	3	1	15	12
50	3	0	4	10	3	1	17	4	3	1	23	8
51	3	0	11	7	3	1	24	14	3	2	3	4
52	3	0	18	4	3	2	4	8	3	2	11	0
53	3	0	25	1	3	2	12	2	3	2	18	12
54	3	1	3	14	3	2	19	12	3	2	26	8
55	3	1	10	11	3	2	27	6	3	3	6	4
56	3	1	17	8	3	3	7	0	3	3	14	0
57	3	1	24	5	3	3	14	10	3	3	21	21
58	3	2	3	2	3	3	22	4	4	0	1	8
59	3	2	9	15	4	0	1	14	4	0	9	4
60	3	2	16	12	4	0	9	8	4	0	17	0
61	3	2	23	9	4	0	17	2	4	0	24	12
62	3	3	2	6	4	0	24	12	4	1	4	8
63	3	3	9	3	4	1	4	6	4	1	12	4

DISTILLER'S SPIRIT TABLE,

SHEWING

THE EXACT VALUE OF ONE GALLON OF SPIRITS OF ANY GIVEN STRENGTH,

WHEN COMPARED WITH ONE GALLON OF ANY OTHER DEGREE OF STRENGTH.

Alco.	1 to 2	1 to 3	1 to 4	1 to 5	1 to 6	1 to 7	1 to 8	1 to 9	1 to 10	1 to 15	1 to 20	H. P.	1 in 20	1 in 15	1 in 10	1 in 9	1 in 8	1 in 7	1 in 6	1 in 5	1 in 4	1 in 3	1 in 2
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
9 6	7 1½	6 4	5 11¼	5 8¼	5 6½	5 5	5 4	5 3¼	5 2½	5 0¾	4 11¾	4 9	4 6	4 5	4 3¼	4 2½	4 1¼	4 0¼	3 11½	3 9½	3 6¾	3 2	2 4½
10 0	7 6	6 8	6 3	6 0	5 10	5 8½	5 7½	5 6½	5 6	5 4	5 3	5 0	4 9	4 8	4 6	4 5¼	4 4½	4 3¼	4 2	4 0	3 9	3 4	2 6
10 6	7 10½	7 0	6 6¼	6 3½	6 1½	6 0	5 10¾	5 10	5 9¼	5 7	5 6	5 3	4 11¼	4 10¼	4 8½	4 8	4 7	4 6	4 4½	4 2¼	3 11¼	3 6	2 7½
11 0	8 3	7 4	6 10½	6 7	6 5	6 3¾	6 2¼	6 1¼	6 0½	5 10¼	5 9¼	5 6	5 2½	5 1½	4 11¼	4 10½	4 9¼	4 8½	4 7	4 4¼	4 1½	3 8	2 9
11 6	8 7½	7 8	7 2¾	6 10¼	6 8½	6 6¼	6 5½	6 4½	6 3¼	6 1½	6 0¼	5 9	5 5½	5 4½	5 2	5 1¼	5 0¼	4 11	4 9½	4 7	4 3¼	3 10	2 10½
12 0	9 0	8 0	7 6	7 2¼	7 0	6 10¼	6 9	6 8	6 7	6 4¼	6 3½	6 0	5 8¼	5 7	5 4¼	5 4	5 3	5 1½	5 0	4 9½	4 6	4 0	3 0
12 6	9 4½	8 4	7 9¾	7 6	7 3½	7 1½	7 0¼	6 11¼	6 10½	6 8	6 6¾	6 3	5 11¼	5 10	5 7½	5 6½	5 5½	5 4¼	5 2½	5 0	4 8¼	4 2	3 1½
13 0	9 9	8 8	8 1½	7 9½	7 7	7 5	7 3¼	7 2¼	7 1¾	6 11	6 9¼	6 6	6 2	6 0¾	5 10	5 9¼	5 8¼	5 6¼	5 5	5 2¼	4 10½	4 4	3 3
13 6	10 1½	9 0	8 5¼	8 1	7 10½	7 8½	7 7	7 6	7 5	7 2¾	7 1	6 9	6 4¼	6 3½	6 0¼	6 0	5 10¼	5 9¼	5 7½	5 4¼	5 0¾	4 6	3 4½
14 0	10 6	9 4	8 9	8 4½	8 2	8 0	7 10½	7 9¼	7 8¼	7 5½	7 4	7 0	6 7¼	6 6¼	6 3½	6 2½	6 1½	6 0	5 10	5 7	5 3	4 8	3 6
14 6	10 10½	9 8	9 0¾	8 8¼	8 5½	8 3¾	8 1¼	8 0½	7 11½	7 8¼	7 7¼	7 3	6 10½	6 9	6 6¼	6 5¼	6 4	6 2½	6 0½	5 9½	5 5¼	4 10	3 7½
15 0	11 3	10 0	9 4½	9 0	8 9	8 6¼	8 5¼	8 4	8 3	8 0	7 10½	7 6	7 1½	7 0	6 9	6 8	6 6¼	6 5	6 3	6 0	5 7½	5 0	3 9
15 6	11 7½	10 4	9 8¼	9 3½	9 0½	8 10¼	8 8½	8 7¼	8 6¼	8 3	8 1¼	7 9	7 4¼	7 2¼	6 11½	6 10½	6 9¼	6 7½	6 5½	6 2¼	5 9¾	5 2	3 10½
16 0	12 0	10 8	10 0	9 7	9 4	9 1½	9 0	8 10½	8 9½	8 6¼	8 4¼	8 0	7 7	7 5½	7 2¼	7 1¼	7 0	6 10¼	6 8	6 4¼	6 0	5 4	4 0
16 6	12 4½	11 0	10 3¼	9 10¼	9 7½	9 5	9 3¼	9 2	9 0¼	8 9½	8 7¼	8 3	7 10	7 8¼	7 5	7 4	7 2½	7 0¼	6 10½	6 7	6 2¼	5 6	4 1½
17 0	12 9	11 4	10 7½	10 2¾	9 11	9 8½	9 6¾	9 5¼	9 4	9 0¾	8 11	8 6	8 0¾	7 11	7 7¼	7 6½	7 5¼	7 3¼	7 1	6 6½	6 4½	5 8	4 3
17 6	13 1½	11 8	10 11¼	10 6	10 2½	10 0	9 10	9 8½	9 7½	9 4	9 2¼	8 9	8 3¼	8 2	7 10½	7 9¼	7 7¼	7 6	7 3½	7 0	6 6¼	5 10	4 4½
18 0	13 6	12 0	11 3	10 9½	10 6	10 3¼	10 1½	10 0	9 10¼	9 7	9 5¼	9 0	8 6½	8 4½	8 1	8 0	7 10½	7 8½	7 6	7 2¼	6 9	6 0	4 6
18 6	13 10½	12 4	11 6¼	11 1	10 9½	10 6¼	10 4¼	10 3¼	10 2	9 10¼	9 8½	9 3	8 9¼	8 7½	8 3¼	8 2½	8 1	7 11	7 8½	7 4¾	6 11¼	6 2	4 7½
19 0	14 3	12 8	11 10½	11 4¼	11 1	10 10¼	10 8¼	10 6½	10 5¼	10 1½	9 11½	9 6	9 0¼	8 10¼	8 6½	8 5¼	8 3¼	8 1½	7 11	7 7	7 1½	6 4	4 9
19 6	14 7½	13 0	12 2¾	11 8¼	11 4½	11 1½	10 11½	10 10	10 8½	10 4¾	10 2¾	9 9	9 3	9 1	8 9¼	8 8	8 6¼	8 4¼	8 1½	7 9½	7 3¾	6 6	4 10½
20 0	15 0	13 4	12 6	12 0	11 8	11 5	11 3	11 1¼	11 0	10 8	10 6	10 0	9 6	9 4	9 0	8 10½	8 9	8 6¾	8 4	8 0	7 6	6 8	5 0
20 6	15 4½	13 8	12 9¾	12 3½	11 11½	11 8½	11 6¼	11 4½	11 3¾	10 11	10 9	10 3	9 8¾	9 6¾	9 2½	9 1¼	8 11½	8 9¼	8 6½	8 2¼	7 8¼	6 10	5 1½
21 0	15 9	14 0	13 1½	12 7	12 3	12 0	11 9¼	11 8	11 6½	11 2¾	11 0¼	10 6	9 11½	9 9½	9 5¼	9 4	9 2¼	9 0	8 9	8 4¼	7 10½	7 0	5 3
21 6	16 1½	14 4	13 5¼	12 10¼	12 6½	12 3¾	12 1	11 11¼	11 9¼	11 5½	11 3¼	10 9	10 2½	10 0¼	9 8	9 6½	9 4¼	9 2½	8 11½	8 7	8 0¾	7 2	5 4[illegible]
22 0	16 6	14 8	13 9	13 2¼	12 10	12 6¾	12 4½	12 2½	12 1	11 8¼	11 6½	11 0	10 5¼	10 3	9 10¼	9 9¼	9 7½	9 5	9 2	8 9½	8 3	7 4	5 6
22 6	16 10½	15 0	14 0¼	13 6	13 1½	12 10¼	12 7¼	12 6	12 4½	12 0	11 9¼	11 3	10 8¼	10 6	10 1½	10 0	9 10	9 7½	9 48	9 0	8 5¼	7 6	5 [illegible]
23 0	17 3	15 4	14 4½	13 2½	13 5	13 1½	12 11¼	12 9¼	12 7¼	12 3	12 0¼	11 6	10 11	10 8¼	10 4	10 2½	10 0¼	9 10¼	9 7	9 2¼	8 7½	7 8	5 9
23 6	17 7½	15 8	14 8¼	14 1	13 8½	13 5	13 2½	13 0½	12 11	12 6¼	12 4	11 9	11 1¼	10 11½	10 6¼	10 5¼	10 3¼	10 0¼	9 9½	9 4¼	8 9¼	7 10	5 10½
24 0	18 0	16 0	15 0	14 4¼	14 0	13 8½	13 6	13 4	13 2¼	12 9½	12 7	12 0	11 4¼	11 2¼	10 9½	10 8	10 6	10 3¼	10 0	9 7	9 0	8 0	6 0
24 6	18 4½	16 4	15 3¾	14 8¼	14 3½	14 0	13 9¼	13 7¼	13 5½	13 0¼	12 10¼	12 3	11 7½	11 5	11 0¼	10 10½	10 8½	10 6	10 2½	9 9½	9 2¼	8 2	6 1½
25 0	18 9	16 8	15 7½	15 0	14 7	14 3¼	14 0¼	13 10½	13 9	13 4	13 1½	12 6	11 10½	11 8	11 3	11 1¼	10 11¼	10 8½	10 5	10 0	9 4½	8 4	6 3
25 6	19 1½	17 0	15 11¼	15 3½	14 10¼	14 6¼	14 4	14 2	14 0¼	13 7	13 4½	12 9	12 1¼	11 10¼	11 5½	11 4	11 1¼	10 11	10 7½	10 2¼	9 6¼	8 6	6 4[illegible]
26 0	19 6	17 4	16 3	15 7	15 2	14 10¼	14 7½	14 5¼	14 3¼	13 10¼	13 7¼	13 0	12 4	12 1½	11 8¼	11 6½	11 4½	11 1½	10 10	10 4¼	9 9	8 8	6 6

RULES FOR CALCULATING THE DIFFERENT STRENGTHS OF SPIRITS.

FIRST.—Divide the quantity by the given strength it may be of either over or under hydrometer proof; if it is over hydrometer proof add the quotient; and on the contrary if it is under the same, subtract it, which gives you the quantity at hydrometer proof.

SECOND.—If your given strength is over hydrometer proof, divide the said hydrometer proof by one more than the said given strength, and deduct the quotient from the said hydrometer proof; and on the contrary, if the given strength should be under hydrometer proof, divide the said hydrometer proof spirits, by one less than the said given strength, and add the quotient to the said hydrometer proof strength.

EXAMPLES.

What quantity of liquor is required to 1000 gallons of spirits at 1 to 5, to reduce it to hydrometer proof.

5) 1000
200 liquor necessary.

1200 quantity when reduced to H. P.

I want to reduce 1000 gallons at 1 to 20 over proof to 1 in 8 under.

20) 1000

50 liquor.

7) 1050 H. P.
150 liquor.
1200 gallons, 1 in 8.

which takes 200 gallons of liquor.

What quantity of spirits, at 1 to 3, is equal to 1000 gallons, at H. P.

4) 1000

250

750 gallons.

Reduce 1000 gallons, at 1 in 10 U. P. to 1 in 5 U. P.

10) 1000
100

4) 900
225 which takes 125 gallons of liquor.

1,125

What quantity of spirits, at 1 to 5 O. P. is equal to 1000 gallons, at H. P.

6) 1000
166 . 2

833 . 2 at 1 to 5 O. P.

Observe—O. P. intimates Over Proof.—H. P. means Proof.—and U. P. is Under Proof.—Likewise TO is Over Proof, and IN is Under Proof, as 1 to 4, 1 to 7, 1 to 2, &c. is so much Over Proof, and 1 in 4, 1 in 7, 1 in 2, &c. is so much Under Proof.

TO MAKE UP RUM, BRANDY, AND HOLLANDS GIN.

It being customary for dealers in spirits to purchase fifty or an hundred puncheons of rum from the importers at once, part of which is bonded, and the remainder taken home; this being supposed to be on the arrival of the Jamaica fleet, and landing of new rums; it is usual to acquaint their correspondents therewith, and the price they then bear, advising them to lay in their stock against next season; by which means, together with the application and industry of a rider, (who spareth no pains for the interest of his employer) orders for many casks are obtained.

Ten puncheons of Jamaica rum, landed at the Custom-house quay, and guaged, &c. as under.

No. 1	—	—	105	Gallons,	—	10	Over Proof.
2	—	—	103	—	—	10	
3	—	—	108	—	—	12	
4	—	—	109	—	—	13	
5	—	—	110	—	—	12	
6	—	—	115	—	—	14	
7	—	—	111	—	—	15	
8	—	—	103	—	—	10	
9	—	—	107	—	—	10	
10	—	—	110	—	—	13	
			1081			119	
To reduce the over proof add water	—	—	119				
			1200	Rum			
To make up, add British spirit	—	—	400				
			1600	Gallons, made up Rum, bearing one to five.			

Preparation

Preparation being made for their reception, the above ten puncheons are carted home, and started into a back,* the over proof reduced with water, the inch is taken, and gives one thousand two hundred gallons; to this is added four hundred gallons of British Spirits, made from molasses; these two quantities put together, make one thousand six hundred gallons, which divided by four, gives four hundred. So here is one part in four that is not rum.

Being well rummaged, and farther reduced with water, to the strength of about one to seven, (the difference in one hundred and five gallons between one to five and one to seven, is just six gallons) the quantity required is pumped up into a vat, or large cask, and from that measured into the puncheons it was originally started from; which, to prevent suspicion to the purchasers, remain in the same state as when they came from the quays; the gain on the measure of each being ascertained, those that yield an advantage exceeding two gallons, are particularized, the gauge-mark and chalks cut out; and on the reverse head of the cask (including the extra measure) is cut a new gauge; they are then ranged in the warehouse as new rums and coloured, so as to have the appearance of variety, though in fact they are all alike.

Having given the process, it is necessary to demonstrate clearly what each cask stands in; that is, the stated expence of each; which may be done as follows:

MADE

* A back is a vessel of large dimensions, properly gauged and inched, which will contain from five hundred or two thousand gallons.

MADE UP RUM.

			£.	s.	d.
Jamaica rum, — 87 gallons, cost 13s. 6d. per gallon			58	14	6
British spirit, added 29 gallons, cost 6s. 6d. per gallon			9	8	6
By gauge and strength 8 gallons.					
——— 124			68	3	0
To be deducted from above; gained by gauge two gallons, 13s. 6d. per gallon — —	1 7 0				
Ditto, gained by strength six gallons, at 13s. 6d. per gallon — — — — —	4 1 0				
			5	8	0
Estimated value first cost — — — —			62	15	0

Charge to the Country Dealer and Customer.

	£.	s.	d.
124 gallons fine Jamaica rum, 1 to 7, at 14s. per gallon	86	16	0
Bought at first cost, at — — — — —	62	15	0
It appears that the dealer gets by making up a clear gain on each puncheon — — — —	24	1	0

When molasses spirits can not be had, they have recourse to the clear rectified malt spirits, which are not so good a flavour.

The aforesaid practice is used in all brandies, as well as in rum, the difference only is, that they are more careful to use molasses in brandy, and not malt spirit, it being more easy to discover deception in brandy than in rum; therefore the practice in one is the same as in the other, as such their profits in 60 puncheons must increase in brandy, more

more than in rum, the price being higher; as such I hope the reader will excuse me making calculatious on brandy as I had before on rum, to prove its price and profit. The same may be said of Hollands Gin, the consumption of which is comparatively small.

THE GAUGE OF SEVERAL WINE PIPES LYING.

	Contents.		Diagonal.			Bulge.	
	Gal.		*In.*	*Ten.*		*In.*	*Ten.*
Lisbon pipe lying —	140	is	37	2	—	32	0
Port ditto — —	136	—	37	2	—	31	4
Sherry ditto — —	133	—	36	5	—	32	0
Madeira ditto — —	100	—	33	3	—	28	0
Wine puncheon lying —	88	—	31	8	—	28	4
Legar lying, bung ditto —	160	—	38	8½	—	34	0
Ditto, bung diameter —	160	—	33	4	—	35	0
Mountain butt — —	126	—	35	9	—	32	0

CONCENTRATION IN THE MAKING UP SPIRITS TO HYDROMETER PROOF.

The deficiency occasioned by the admixture of water with spirits at the different strengths, properly called Concentration, is as follows:

Gal.	*Gal.*	*Gal.*	*Gal.*
75 to the 100 over proof —	5	57 — — —	3¼
72½ — — —	4¾	55 — — —	3
70 — — —	4½	51½ — — —	2¾
67½ — — —	4¼	48½ — — —	2½
66 — — —	4	45 — — —	2¼
62½ — — —	3¾	41½ — — —	2
60 — — —	3½	37½ — — —	1¾

33 to

Gal.		Gal.	Gal.		Gal.
33	to the 100 over proof —	1½	12	to the 100 under proof	0¼
28½	— — —	1¼	20	— — —	0½
24	— — —	1	30	— — —	0¾
19½	— — —	0¾	40	— — —	1
15	— — —	0½	50	— — —	0¾
10	— — —	0¼	60	— — —	0½
			70	— — —	0¼

THE QUALITIES OF RECTIFIED SPIRIT OF WINE.

A spirit distilled from wine or other fermented liquors, purified as much as possible from its fetid smell, and the phlegm that arises with it in the first distillation.

We have seen that these spirits, from whatever vegetable subjects they have been produced, are, when perfectly pure, the same. They have a hot pungent taste, without any particular flavour ; they readily catch flame, and burn entirely away, without leaving any marks of an aqueous moisture behind ; distilled by a heat less than that of boiling water, they totally arise, the last runnings proving as flavourless and inflammable as the first : they dissolve essential vegetable oils and resins into an uniform transparent fluid. These spirits are the lightest of almost all known liquors : expressed oils, which swim upon water, sink in these to the bottom : a measure which contains ten ounces by weight of water, will hold little more than eight and a quarter of pure spirit.

The uses of vinous spirits, as menstrua for the virtues of other medicines, we have seen, and in this place consider only their own. Pure alkohol coagulates all the fluids of animal bodies, except urine, and hardens the solid parts. Applied externally, it strengthens the

vessels,

vessels, thickens the juices in them, and thus powerfully restrains hæmorrhages. It instantly contracts the extremities of the nerves it touches, and deprives them of sense and motion; by these means easing them of pain, but at the same time destroying their use. Hence employing spirituous liquors in fomentations (notwithstanding the specious titles of vivifying, heating, restoring mobility, resolving, dissipating, and the like, usually attributed to them) may sometimes be attended with unhappy consequences. These liquors, received undiluted into the stomach, produce the same effects, thickening the fluid, and contracting all the solid parts which they touch, and destroying, at least for a time, their use and office: if the quantity be considerable, a palsy or apoplexy follows, which ends in death. Taken in small quantity, and duly diluted, they brace up the fibres, raise the spirits, and promote agility: if further continued, the senses are disordered, voluntary motion destroyed, and at length the same inconveniences brought on as before. Vinous spirits therefore, in small doses, and properly diluted, may be applied to useful purposes in the cure of diseases; whilst in larger ones, or if their use be long continued, they act as a poison of a particular kind.

PROOF SPIRIT.

The same spirit, containing an admixture of an equal quantity of water: the best proof spirit is that distilled from French wine; but for common uses may be employed the spirit drawn from molasses, or the syrupy matter that runs from sugar in the purification, commonly called molasses spirit.

The spirits usually met with under the name of proof, are those distilled from different fermented liquors, freed from their phlegm and ill flavour only to a certain degree. Their purity with regard to flavour may be easily judged from the taste, especially if the spirit be

first

first duly diluted. It were to be wished, that we had a certain standard with regard to their strength, or the quantity of water contained in them; a circumstance which greatly influences sundry medicinal preparations, particularly the tinctures; for as pure spirit dissolves the resin and volatile oil, and water only the gummy and saline parts of vegetables, it is evident that a variation in the proportions wherein these are mixed, will vary the dissolving power of the menstruum, and consequently the virtue of the preparation. The common methods of estimating the quantity of phlegm contained in these spirits are liable to uncertainty; it should therefore seem necessary for the nicer purposes, and where a perfectly flavourless proof spirit is required, to make use of the pure rectified spirit, mixed with a certain determined proportion of water; equal quantities of these liquors, whether taken by weight or measure, compose a spirit somewhat weaker than what has been generally looked upon as proof; the more exact proportions are, one hundred parts by weight of pure spirit, and eighty-six of water.

On account of the variety of strengths that proof spirit has been remarked at in this treatise, it becomes necessary to observe here, that the most exact is that mentioned in the Malt Distiller's Table, No. 1. That just now noted of one hundred and eighty-six parts, by weight, of alkohol, and eighty-six of water, I cannot at present speak to with that precision I wish: in another place it is said, twenty parts of alkohol and seventeen of water is proof. Government, as appears by the Malt Distiller's Table, No. 3, compute hydrometer proof at the temperature of fifty degrees of Farenheit's thermometer to be equal parts, by measure, of alkohol and water, which must therefore be the standard by which the duties are paid, and consequently the regulation by which they should be sold.

DISTILLED SPIRITUOUS WATERS.

By *distilled spirits* are understood such as are drawn with a spirit that has been previously rectified, or which is reduced nearly to that strength in the operation; by *spirituous waters*, those in which the spirit is only of the proof strength, or contains an admixture of about an equal measure of water. These last have been usually called compound waters, even when distilled from one ingredient only; as those, on the other hand, which are drawn by common water, though from a number of ingredients, are named simple; the title *simplex*, here, relating not to simplicity in respect of composition, but to the vehicle's being *plain* water. The Edinburgh pharmacopœia denominates those waters simple which are drawn from a single ingredient, whether the vehicle be common water, or spirituous water, and all those compounds which are distilled from more than one.

General Rules for the Distillation of Spirituous Waters.

1. The plants and their parts ought to be moderately and newly dried, except such as are ordered to be fresh gathered.

2. After the ingredients have been steeped in the spirit for the time prescribed, add as much water as will be sufficient to prevent an empyreuma, or burnt flavour, or rather more.

3. The liquor which comes over first in the distillation, is by some kept by itself under the title of spirit; and the other runnings, which prove milky, fined down by art. But it is better to mix all the runnings together, without fining them, that the waters may possess the

virtues

virtues of the plant entire; which is a circumstance to be more regarded than their fineness or sightliness.

If the distillation be skilfully managed, the heat equable, and all along gentle, and no more drawn off than the quantity directed, most of the waters will appear sufficiently bright and fine: some of them, which look turbid just after they are drawn, will, on standing for a few days, become clear and transparent. The practice here forbidden, of saving some of the first runnings apart, is certainly very injurious to the composition; the water being not only robbed by it of some of the more volatile parts of the ingredients, but likewise rendered permanently milky, as wanting the spirit which, by dissolving the oil of the ingredients that gives this appearance, would make the liquor transparent. Nor is the method of fining the turbid waters by alum, &c. less culpable; for these additions produce their effects only by separating from the liquor what it had before gained from the ingredients.

4. In the distillation of these waters, the genuine brandy obtained from wine is directed. Where this is not to be had, take instead of that proof spirit, half its quantity of a well-rectified spirit prepared from any other fermented liquors. In this steep the ingredients, and then add spring water enough, both to make up the quantity ordered to be drawn off, and to prevent burning.

By this method more elegant waters may be obtained, than when any of the common proof spirits, even that of wine itself, are made use of. All vinous spirits receive some flavour from the matter from which they are extracted; and of this flavour, which adheres chiefly to the phlegm or watery part, they connot be divested without separating the phlegm, and reducing them to the rectified state of spirits of wine. See Disquisition on Spirituous Liquors in the Second Book.

BALSAMUM VITÆ.

Take of cinnamon one ounce and a half; ginger, one ounce; mint one ounce; oil of vitriol, six ounces; rectified spirit of wine, two pounds.

Drop the oil of vitriol by little and little into the spirit of wine, and digest them together in a sand-bath, with a very gentle heat, for three days: then add the other ingredients; continue the digestion, in the same gentle heat, for three days longer; and afterwards filter the tincture in a glass funnel.

The intention in these processes is, to obtain a tincture of aromatic vegetables, in spirit of wine, combined with a considerable proportion of vitriolic acid. When the tincture is first drawn with vinous spirits, and the acid added afterwards, as in the first of the above prescriptions, the acid precipitates great part of what the spirit had before taken up; and, on the other hand, when the acid is mixed with the spirit immediately before the extraction, as in the second process, it prevents the dissolution of all that it would have precipitated by the former way of treatment. By previously uniting the acid and the vinous spirit together by digestion, as in the last process, the inconvenience is somewhat lessened.

All these compositions are valuable medicines in weakness and relaxations of the stomach, and decays of constitutions, particularly in those which are accompanied with slow febrile symptoms, or which follow the suppression of the intermittents. They have frequently taken place after bitters and aromatics, by themselves, had availed nothing; and, indeed, great part of their virtue depends on the vitriolic acid; which, barely diluted with water, has, in these cases, where the stomach could bear the acidity, produced happy effects.

Fuller relates (in his Medicina Gymnastica) that he was recovered, by Mynsicht's Elixir, from an extreme decay of constitution, and continual retchings to vomit. They may all be given from ten to thirty or forty drops, or more, according to the quantity of acid, twice or thrice a day, at such times as the stomach is most empty.

SWEET ELIXIR OF VITRIOL.

Take of the aromatic tincture, one pint; dulcified spirit of vitriol, eight ounces by weight. Mix them together.

This is designed for persons whose stomach is too weak to bear the foregoing acid elixir. To the taste, it is gratefully aromatic, without any perceptible acidity. The dulcified spirit of vitriol, here directed, occasions little or no precipitation upon adding it to the tincture.

The college of Edinburgh, in a former edition of their pharmacopœia, employed dulcified spirit of vitriol as the menstruum. The composition was as follows;

Take of dulcified spirit of vitriol, two pounds; Essential oil of mint, half an ounce; of lemon peel, of nutmegs, each two drams. Gradually drop the oils into the spirit, and mix the whole well together.

This elixir, if the essential oils be good, and the dulcified spirit made as it ought to be; (if it be not, it will not dissolve the oils) proves a very elegant and grateful stomachic, similar to the foregoing sweet elixir: a tea-spoonful of either may be taken two or three times a day.

A medicine of this kind was formerly in great esteem, under the title

title of *Vigani's Volatile Elixir of Vitriol;* the composition of which was first communicated to the public in the *Pharmacopœia Reformata.* It is prepared by digesting some volatile spirit of vitriol upon a small quantity of mint-leaves, curiously dried, till the liquor has acquired a fine green colour. If the spirit, as it frequently does, partakes too much of the acid, this colour will not succeed : in such case it should be rectified from a little fixt alkaline salt, as hereafter directed. The mint is most commodiously suspended in the spirit in a fine linen cloth: this prevents the necessity of filtration, during which the more volatile parts will exhale.

This excellent restorative balsamic elixir may be extemporaneously made without distillation, as follows: Take of the essential oil of cinnamon, lavender, mint, and Jamaica pepper, each a quarter of an ounce; orange and lemon peel, nicely pared, so to have none of the inner white part, each two ounces. The essential oil of cinnamon being so excessively dear, the essential oil of *cassia lignea* may be substituted in its stead, observing to take it in a duplicate proportion to the other; balsam of Peru, one dram; rectified spirit of wine, two pounds.

This fragrant, elegant, and most sanative balsam, is prepared as follows: Dissolve the balsam in the spirit; drop the essential oils by little and little in afterwards, and digest the whole together; if the oils are good, it will be perfectly bright.

It is not only a restorative in all cases where the constitution has been weakened by excesses in wine, but in the usual injuries derived from the immoderate use or abuse of spirituous liquors; from thirty to forty drops taken in wine is a sufficient dose. It also relieves in faintings, langours, and other debilities of the nervous system, cholics, lancinating pains in the bowels, &c. Internally, but also externally, in vertigenous, lethargic, and the like complaints, it gives immediate relief, applied to the nostrils, temples, &c.

THE

THE DISTILLERS' OR RECTIFIERS' DIRECTORY.

1. In rectifying and distilling compound goods a smaller still is known to make a cleaner and better commodity than one that's larger: and one that's half a hogshead gage, over and above your hand breadth depth from the edge or top of your still, is accounted the fittest size for a moderate trade; both as it may be managed without fatigue, and as it produces encouraging profit much superior to the fund it requires. This is a smaller scale than the London distillers work upon.

2. When you erect and place your still, and other utensils thereunto belonging, let it be, if possible, in a building, out-house, or shed, separate from, but near adjoining to your dwelling-house, or shop, to prevent any hazard which may arise by fire, to which all spirituous goods are liable; and no otherwise to be extinguished, but with a woollen blanket or rug, drenched in water, and cast upon the flame, which extinguishes it by excluding the air.

3. Let your work-house be large enough, not only in regard to your still, worm-tub and pump, which must be all placed in a row, or ranged together, to contribute to your working with ease and pleasure, but because your spirits which are for distilling, must lie in some proper place or part of your work-house, to be near at hand to charge

charge your still with, and at some reasonable distance from the fire; and also that you may have room enough for placing all your empty vessels, tubs, cans, and other utensils properly belonging to the distilling trade, to have them near at hand on all occasions; and let your still-house-floor be paved with broad stones or flags, having a descent to carry of all the wash from your still, your hot liquor from the worm-tub, and other occasional slop, which will be made by washing your casks, &c. whereby your still-house-floor will always be kept clean. They are usually kept in a cistern underneath, and pumped up as wanted.

4. It is absolutely necessary, and what you must first of all be apprized of, that there be sufficiency of water where your pump is to be sunk, both to keep your worm-tub continually cool, to make up all your goods to their proper strength, and to serve all other occasions whatsoever: it matters not whether your water be soft or hard, if you have but plenty of it.

5. Your still must be placed upon brick-work, having an ash-hole of twenty-four inches long, nine inches broad; and to the iron bars, where your fire is to be under your still, twenty one, or twenty two inches high; made somewhat sloping, the better to command the ashes.

When your brick-work is made about the height last mentioned, you must place your grate-door (both of strong iron) before, or in the forefront of the stove, or place where your fire is to be made under your still. The said iron door and frame must be about ten inches long, and eight inches broad; close behind the said door and frame, must be placed two cross iron bars, about two inches and an half broad, half an inch thick, and fifteen or sixteen inches long: both ends of which bars must be laid about three inches into the brick-work, for fixing them the better; and the upper part thereof must be about

half

half an inch lower than the upper edge of the door-frames. Just behind the said two iron bars must be placed another flat iron bar, about an inch and an half broad, half an inch thick, and sixteen inches long, fastened in the brick-work as the former, and near an inch lower: upon which last-mentioned flat iron bar your iron grate must rest at the higher end; and the other ends of your iron grate must rest upon another flat iron bar of the same dimension fastened at the furthest end, or most distant part of your still-bottom.

The iron grate must consist of about eight bars of inch square iron, but exactly of one length, made broad, or flatted diagonally at each end, to rest on the said two cross iron bars, so as the upper part of the square bars must be even with the higher part of the flat iron bars on which they rest, that the fire-shovel, or coal-rake, may run smoothly along them. The said square iron bars must be about eighteen inches long, and laid loose within an inch breadth of each other upon the aforesaid two broad iron bars, as firm as you can, yet so as they may be put in, or taken out as occasion requires; then raise your brick-work, so as your still-bottom, when fixed, or rested thereupon, may be about ten or twelve inches above the iron grate, that the fire may have room to play; and the part of the brick-work under the still, where the fire is placed, and whither it extends within the stove, must be inlaid with hearth inch-tiles, or fire-brick, well fastened with such mortar as will abide the fire much longer than common bricks. Let not the fire-place be too broad, wherein your workman's judgment will have regard to the sides not being of the same thickness with the bottom of your still. There must be left a sloping place, or hole proper for conveying the smoak into the flue and round the still into the chimney; which flue must be carryed up a convenient height, to draw the smoak, and carry it off. Let your still-cock come so far through the brick-work, as your wash may run out either into cans, or otherwise, as you have conveniency for conveying it away. The brick-work about your still must be exactly

 round,

round, as high as the upper nails of your still, sloping from the flame, lest any goods boil over; and very well mortared, and covered all round with coarse canvas or hop-sack, to keep the fire closer in, the wall from cracking, and your clothes from being abused thereby, and the flew plastered well within.

Your worm-tub must be placed very near your still upon a strong wood-frame, according to the size of your tub, which must be six or eight times the capacity of your still, so as every stave of the tub may rest firmly upon the frame, the better to support the great weight of such a quantity of liquor as is necessary so keep the worm constantly cold, or cool enough. Your worm-tub-frame must be so high, as when the tub is placed upon it, the low end of your worm which comes though the worm-tub will admit of your cans being readily placed under, and taken away when they are full. The upper end of your worm must be placed so, as the arm of your still-head may go into it without any difficulty, and shut in so close as to be easily luted; and your worm-tub must stand so upright as no liquor may hang in the worm, which you may know, by putting a pint or quart of water into the worm, which will run out at the lower end of your worm. In the middle of your worm-tub you may place a wood-gutter three or four inches square within, to reach from the top of the worm-tub to the bottom of the same, having about three or four inches on the opposite sides at the bottom end of it left open, that the liquor that is pumped into the gutter, which descends, may flow out at the said two breaches to the lower part of the worm-tub, which forces all the hot water to ascend upwards, and runs either over the worm-tub, or rather through a leaden pipe of a moderate size, which is called a waste pipe, being put through, and soldered in your worm-tub, and extended down your tub-sides, to what further length you please, to convey the warm water from your tub, till the liquor in your worm-tub be perfectly cold; which by the continuance of your still working will grow hot again and again, must be still cooled after the

same

same manner. The water conveyed in by a lead-pipe at the bottom, is still better.

7. Your pump must be placed next your worm-tub, and of such a height as you may have a spout or cock put into that part of your pump, which is next your worm-tub, under which you may fix a good gutter, to reach to, and be led into the gutter, that is fixed in the middle of your worm-tub, that the liquor may be more easily, and with less waste, conveyed into your worm-tub, in order to cool it. You must have also another spout or cock in the fore-part of your pump, much lower than the other, for drawing liquor for all common uses, the higher spout being closed, and only appropriated for cooling the liquor, when hot in the worm-tub.

8. It will be necessary also to have a large liquor-back, set upon a strong frame, to command the worm-tub, and to contain a large quantity of water, having a large brass cock therein communicating with the still, &c. to draw off what liquor you may stand in need of suddenly; which may be of very great service to you upon any emergency; and may be drawn off in much less time, and with less trouble than by pumping: for the still may accidentally be sometimes dry, and prove of dangerous consequence, if you had not a quantity of liquor ready on all occasions in your liquor-back to repair to. Your water-tub must be open at the upper end, that you may dip or drench your cans into it, or lay any small rundlets in it, to steep and become tight; and that your tub may be more easily filled with water.

9. You will find your interest in keeping a good middle-sized press, placed in a corner of your still-house, and fixed so steadily, as not to be moved when you use it, having a very strong bed or place, in which the goods to be pressed are put; and five or six hair-cloths, somewhat broader than your press, to be put betwixt every layer of elder-berries, cherries, raspberries, or any other things which are to be

 pressed;

pressed; all which are to be laid as thin as possible, and your press-screw to be drawn pretty much till the liquor run by a spout made of sheet-lead, nailed to the fore-part of the bottom of your press, into one of your cans, which must be placed under it, to receive the juice from the press, and draw out your iron-pin, to give time to the press to empty itself of what juice lies in the bed; then draw the screw a little closer, and allow time for the juice to run out, and so more and more, till all the juice is wholly drawn or pressed out of the goods.

10. You must have also at least three or four iron-bound open-headed tubs, wide at the top, and narrower, taper-wise down to the bottom, (one of these tubs is to contain two puncheons or pipes of goods, another to contain one pipe, and another a hogshead) which must be placed orderly in your still-house, and now and then filled with hot liquor out of your still; and the iron hoops driven, or fastened, to keep them firm, and in fit condition to hold the goods that are to be put, or made up in them.

11. You must also have three or four iron-bound cans, either with iron round hands or bales; one to hold five, another to contain four, another three; and if you please, another two gallons; not by bare measure to the top, but let your goods reach no higher than a brass mark placed therein, determining the measure, to which the liquor must rise.

12. Another necessary utensil is an iron-bound wood funnel, which by computation would hold three or four gallons, with a strong iron nosel or pipe to put into the bungs of the casks which the goods are to be put in; which must be ranged or placed upon a shelf along with iron-bound cans pretty near your still.

13. In some convenient part of your still-housc where room may be most spared, must be placed a pretty large vessel, either covered or open, as you please, upon a stillyon or guntree, with a cock in it, in which you must put all your feints or after-runnings, until you have a quantity worth your distilling over; into which vessel or cask you may put the washings out of your casks, the drippings of your cocks, any goods accidentally spoiled, either by wrong mixture, spilling on the ground, or otherwise; or any thing else that has a spirituous matter or substance in it.

14. Another piece of necessary furniture for your still-house, and which cannot be dispensed with, is a good strong copper or tin-pump of about five feet long, and six inches in circumference, its nosel about six inches from the top of the pump, and the said nosel about fourteen inches long from the body of the pump; besides a little angular nosel about four inches, to be put on upon the other, or taken off as your occasions require. The use of this pump with its appurtenances, is to draw off your spirits out of the pieces into your cans to charge your still with; and for many other purposes in which it will be serviceable.

15. A pewter-crane is also absolutely necessary, made somewhat semi-lunar, or like a half-moon or angle, about six feet and an half from one end to another, and four inches round about on the outside, to draw goods out of any vessel where the pump cannot play.

16. A pewter-valencia is also useful, being about two feet long, tapering at the end, which you put into the piece, or any other vessel, to draw out any small quantity, by putting or moving your finger on the upper side of the valencia whereby the liquor enters, for your tasting or trying its proof; which with the crane, may be hung against the wall.

17. Hypocrates's

17. Hypocrates's bag, or flannel-sleeve, is another thing very necessary for the distiller, whereby all bottoms of casks, though never so thick and feculent, by putting into this bag or sleeve to filtre, become presently clear, the porous parts of the said bag being soon filled with the grosser matter; and the thin or liquid element runs clear from the bag, and is as good as any of the rest: also any foul goods or liquor may presently be made clear and fine, by putting some powdered alabaster into the goods or liquor, or sprinkling the same on the bag to stop up its pores, by which they presently become, or run clear, leaving nothing but the sediment or gross matter in the bag; nor do the goods or liquor contract the least ill-flavour from the said alabaster-powder.

The said bag or sleeve is made of a yard or ell of flannel, not over fine or close-wrought, laid sloping, so as to have the bottom of it very narrow, and the top as broad as the cloth will allow, well sewed up the side, and the upper-part of the bag folded about a broad wood-hoop, and well fastened to it; then boring the hoop in three or four places, it may be suspended by a cord.

18. You must have for your still-fire a large poker, fire-shovel, and coal-rake, with other necessary utensils for your still-house; a cooper's hand-saw, adze, gimlet, a striking gimlet, a hammer, a pair of scratching-irons, a pair of tarriers, a bung-borer, a box-foreset, and a box of bungs.

19. When you are to distil, you are to make ready, against your still is charged, a paste of the bigness of a turkey-egg, made half of Spanish wheat, and the other half of rye-meal, bean-meal, or wheat-flower, well mixed together, and made into a paste with water, of the consistence of an ordinary paste for baking; and having put on your still-head, with its nose in the upper-end of the worm, then take your paste, working and making it plyable with the heat and operation of

your

your hands, and spread it upon the junctures of the body and head of your still, and that part of the arm of your still-head which goes into the end of the worm, to keep in the goods from boiling over: make the paste very smooth, by wetting your hand (with which you lay on the paste) oft times in water, to cause it to lie the closer, and secure the goods from all events, and reserve a piece of paste, about the size of a small apple, lest the luting should crack or break out, which is very dangerous, and must therefore be carefully attended to and examined, and, in case of any defect, mended with the paste reserved for that purpose.

20. When you set up a new still, which has not been used, let it be filled, within your hand-breadth of the brim, with liquor, and put to it a peck of wheat-bran, and put the head upon the still, and fix it firmly on with a wood bar, about the thickness of your wrist, upon the loop, a little below the neck of your still; and the upper-end of the said wood-bar must be fastened under some beam or lentel perpendicularly, to prevent the still-head from moving by the force of distillation; then lute your still as directed in the foregoing paragraph; and having made a fire under your still proper for that purpose, draw off two, three, or four gallon cans by distillation, whereby all the joints and nails of your still will be cemented, and made fit for distilling your strongest proof goods; then damp or extinguish your fire with some wet ashes; wash your still-head and worm; afterwards you may charge and work your still with what goods you please.

21. All your spirits to be distilled should be proof goods, which you try by having a small quantity put into a glass phial, and shaking it with your hand; if the blebs or proof of it continues a pretty while upon the top or surface of the goods, it is then what is called proof goods; and when it is distilled, it will yield about, or very near, two-third parts, or every thirty gallons will distil to near, and some-

times

times full, twenty gallons, according as the spirits are higher or lower proof; which you may make proof, or to what strength and weakness you please, by adding that proportion or quantity either of spring or river water, as is necessary thereto; as for example, take and observe this general rule in distilling, that all double goods coming from the still, clear proof and without feints, must be made up with liquor to that quantity you charged your still with at first; as if with thirty gallons of proof spirits, it will yield (as above noted) about twenty gallons of high proof goods, the deficiency of ten gallons must be made up with liquor, till the whole amount to thirty gallons, your first charge; and in single goods you add one and an half part more of liquor (*viz.* fifteen gallons) to what is ordered in double goods, whereby you will have in all forty-five gallons of single goods: but if your spirits are below proof, upon your shaking the the phial, or glass, the goods will fall flat, or the blebs or proof thereof will not continue on the surface of it; and according to the degree of its being reduced more or less below proof, the goods will flatten accordingly; and when such goods are distilled, they will fall short in quantity; and upon making them proof, and no otherways will you know what body they were of, and how far they were reduced, except by the hydrometer.

22. When your still is charged with goods for distilling, and luted, then make your fire under the still; which if possible must be of coals, because their heat is most constant and durable, and wood fires are very subject to both extremes, of too much or too little heat, which are prejudicial and sometimes hazardous.

Let your fire be first pretty moderate, and then by degrees increased, and now and then stirred up with your poker, as is usual in common fires; and by laying your hand upon the body of your still, as the fire gains strength in the stove or furnace under the still, you will by moderate degrees ascend up your still-head, occasioned by the goods

goods in the still boiling higher and higher. When your still-head becomes warm or hot, then prepare a damp (which is to check or lessen the violence of the fire), which damp is made of about half a bushel of ashes taken from under the stove or furnace, and two or three gallons of the liquor cast upon and well mixed with them, upon the ground or hearth, before or under your kiln door, to be ready to cast upon the fire, when there is occasion so to do: and move your hand upon the still, higher and higher, as you find the heat grow hotter, and ascend to the neck of your still-head: which when it comes with any vehemence more than a common warmth, to turn downwards towards the worm-end, in which the arm of the still is luted, cast three or four fire-shovels of wet ashes upon the hottest part of the fire, which must be done very smartly and critically, at the very turning of the highest part of the swan-like neck of your still towards the still; whereby the violence of the fire is abated, which would otherwise bring down the goods through the worm very foul in a rushing stream; which is dangerous, and by all means to be prevented: whereas your damping the fire seasonably, brings down the liquid like a small twine thread.

23. You must take especial care not to touch or meddle with your fire while your still is near coming to work, because of increasing or heightening the heat, which would unavoidably make your still run foul: but when your fire is damped and come to work, you may let your kiln-door be shut close, and continue so, as long as the worm runs as small as a moderate large turkey quill. But as the kiln-door being long shut will overcome the damp, and bring the fire to its former violence, so when you are apprehensive of it you may throw open the kiln-door, which abates the heat immediately, and lessens the stream flowing from your worm; and you must cautiously meddle with your still-fire until more than one or two cans be come off from your still, which is about double the strength of the first goods, and then there is less danger, and you may more

 safely

safely stir up or mend your fire, or shut your kiln-door, to make your goods come down with a little larger stream, until the goods be wholly come off from the still.

24. When you perceive near two third parts of the first quantity which you put into your still to be run from thence, then be often tasting the goods, which must run as long as any strength remains; when all the goods are come off, the former clear colour of the goods will turn to a blue, and sometimes, according to the nature of the goods, of a whitish colour, which are phlegmatic and foul, and if they were suffered to run amongst the goods, would make them taste disagreeably; but by being kept by themselves, the goods are clean and well-tasted; and the feints, or after runnings, being put and kept in a vessel until you have a quantity together, you may then distil them, (I mean the feints, charging your still within a hand-breadth of the brim, and casting two or three pounds of salt to each still, and drawing them off as other goods, as long as the strength continues in the spirits, which generally will be about one-fourth part of the whole. When the strength of the spirits is gone, or run off, take away your can of goods, and let the feints run into another can, as long as the feints will burn on the still-head, being cast thereon and a candle or lighted paper put to it to try the experiment.

25. When your feints are drawn into spirits, which must be made proof, that you may make a better judgment how to convert them to other goods, you must always make them into such goods as carry a very predominant or prevailing gust or taste, above other ingredients: and therefore the common and usual method taken with them, is to convert them into aniseed or worm-wood cordials; putting a little more than the receipt of ingredients, which is made use of, the same goods being drawn from clean malt-spirits: and also dulcifying a little higher than otherwise, purposely to cleanse or carry off

off any ill relish contracted from the multiplicity of mixtures in the feints.

26. You must always keep the water in the worm-tub very cold or cool, that the goods coming off the still may be perfectly so; which will contribute to bettering the goods, and making them settle sooner; whereas the goods coming off warm or hot from the still, they lose considerably of their strength, which is extracted by the hot liquor, become more palatable, and not without much time and difficulty are made fine.

27. When you distil any goods which are not above one-third, or one-half of the quantity your still will work, be sure you add one, two, or three cans of liquor to the goods you charge your still with, both for better preserving the still from damage, and because the goods will cleanse and fine themselves, by having a quantity of liquor with them wrought together, and will run considerably more from the still than when it is charged with full-proof goods; not that they can possibly be more in strength or substance, but by their being weakened with liquor put to them, are drawn lower, and require less liquor to make them proof.

28. When you draw off your still more than once a day, if your second distillation be of the same goods with the first, and the quantity of each the same, then when your goods and feints are drawn off, damp your fire very well under your still, draw the wash quite out of your still, and, without cleaning out the ingredients, you may charge it a second time with the spirits and ingredients, and draw off your goods as at other times; but if you charge your still a second time with the same goods, and no greater quantity than what the goods run from what your still was first charged with, then, when your goods are come off and without suffering the feints to run, damp your fire, strike off your still-head, and charge your still accordingly

 with

with your ingredients, and draw them off as you do at other times; but if you charge your still a second time the same day with goods different from, and of another sort than what your still was first charged with, then clean your still of all the wash and ingredients, scrape off all the luting on the still-head and upper part of the body of your still, which remained or was left on the still-head, wash down the worm with about a gallon of liquor, to prevent all obstructions therein; and draw off your goods of the second charging or distillation, as you do at other times; nothing differing either in drawing off or making up the goods from what you do when your still is charged with no other goods, or only one distillation made thereof at that time.

29. Be sure that betwixt every new charging your still you scrape off all the paste or luting which cleaves or is burned to the still-head, or the brim of your still, which might endanger your new luting to crack or break, were it put upon the old paste or luting; and also let your worm be constantly washed down with a gallon of liquor, lest any thing be accidentally got into the worm, which might prove of the worst consequence, and must therefore be prevented or guarded against by the greatest caution you can possibly take therein.

30. It conduces to meliorate your goods when the ingredients of which they are made are infused in spirits over night, before they are distilled, which spirits must cover the ingredients, and being measured, you must allow what they measured out of the quantity you put into your still; so that both the spirits in which the ingredients are infused and the other which you measure into your still must together make up the intended quantity: and let all your ingredients, according to their several kinds, be bruised, sliced, or otherwise dissevered, before their infusion, if you have time and opportunity for so doing.

Take special care that no manner of grease, tallow, soap, or any other

other such like unctuous matter, get or fall into your pieces, tubs, rundlets, or cans, because they quite take off all manner of proof of the goods, and although their strength be very high, yet they will apparently fall as flat as water, and then their strength can only be ascertained by the hydrometer.

32. Above all things beware of lighted candles, torches, papers, or other combustible matter, being brought too near your still, or any vessel where your goods are contained, which are subject to take fire upon very slight occasions; as it is in itself most dreadful, being compared to fire and gunpowder, and no other ways to be extinguished than is directed in the second paragraph of this directory.

33. You must take care to have your stove-chimney and flew, pretty often swept or cleaned : both to prevent the danger of its taking fire, and to make your flew, or kiln-chimney, draw the better, whereby your stove-fire will be first lighted and afterwards continued with less trouble.

34. It is best for preserving the strength and flavour of your goods, that as they come off your still into your cans, exactly filled up to the mark of a four or five gallon measure, they be emptied into the casks they are to be kept in ; always noting, or keeping an account of the several cans or quantity of goods to be put by ; which must be made up to their several proportions, according to the quality or kind of goods so to be made up ; which is, or must be, by adding so much liquor or pump water, as completes the same. And in dulcifying your goods, first weigh your sugar you intend to put in ; then dissolve it in one or more cans of your liquor, with which you make up your goods ; bruising all the lumps of the sugar, and stirring it very well with a rummager in your cans, till all is dissolved ; and then emptying it into your other goods ; and mixing all well together, by drawing off several cans of the goods at the cocks, and putting

putting them in again at the bungs; and then rummage all well together, till they are perfectly well mixed and compounded.

35. When you have made up your goods to the quantity and quality you intend, that they may become fine and clear; all your goods which are made proof will without any art or composition settle, and become fine and clear, within one or two days at most; but goods that are reduced below proof, the weaker they are made in strength, the longer they are in becoming fine or saleable. To every hogshead of Geneva, or strong waters, put five or six ounces of alum powdered, so as to go through a coarse hair-sieve, and mixed in three or four gallons of the goods, well stirred or dissolved in your cans, and then put to your whole quantity, rummaged and very well stirred together, some cans of goods being drawn off, and put to the goods again, to mix them the better. And the Geneva will be clear in one day; and the other in two or three days.

36 When your distilled goods are finished, being set upon a stillyon or pair of guntrees, in order to their being drawn off, you must let the bungs of the casks continue open, till they are become fine and fit for use: then you may put the bungs in, but not too hard, and set a forset or a plug-hole, and a forset, or plug put slightly therein, in a proper place of your casks, to take out or loosen, to give vent when you draw off any goods: it is a vulgar error to suppose that goods are materially injured or weakened by the bungs being left open; for where there is any quantity of goods of any tolerable body or strength, they receive no manner of injury thereby, but mellow and clear more and more by having good vent either by bung or forset.

37. You may make any goods deeper or lighter coloured, by dulcifying with browner or finer sugar. And as all common goods bear a low price, they are always sweetened with the cheapest brown sugars, which commonly make them of a deep amber colour, which by

by long custom and usage has so prevailed with the populace, that goods of a lighter colour, occasioned by being dulcifyed with better sugar, are less accounted of; whereas fine goods, which are generally drank by persons of judgment and distinguishing palates, must be made up with fine sugars; and the clearer and lighter colour they are the more acceptable and valuable to those who know what they buy; and some persons are so nice this way, as to dulcify with loaf sugar; but the sugars in your receipts specified are what will give a general satisfaction to all your customers.

38. When you first draw off any goods lately distilled, that which lies next the cork will not be clear, or left fine, according as the goods have been a longer or shorter time distilled; and must be set aside till you have drawn off what fine goods you have present occasion for; and then you may put what you first drew in at the bung, and it will settle in a very little time; and when any of your standard or other casks are near out, or to be emptied and drawn off, let all the bottoms be drawn into one of your cans, and first put one, two, or three gallons of liquor, according to the size of your cask, to wash out the cask; and let your first liquor with which the cask is washed be put among your feints; and what liquor you wash clean out with must be cast away; then take your can of bottoms, and first hanging up your flannel sleeve in some convenient place, put your bottoms into it all at once, if your bag will hold it. The first runnings of the bag will be foul till all the porous parts of the bag be filled up with the seddiment that is amongst the bottoms of the casks; and when they run fine, you may take away the foul goods, and put a clean vessel to receive the fine goods; and when the bag is run nearly out, you may put in it what goods first run foul when the bottoms were put into the bag, and let the bag hang till all the goods be quite run off from the sediment, which must be then cast away, but the fine goods, so filtered through the flannel sleeve, will be as good and wholesome as any of the rest; and the bottoms of fine goods, which are

are much more valuable, must be filtered, or put through blotting paper, folded in four parts, one part or leaf to be opened funnelwise, and made capable to receive what it will hold of the bottoms, being put into the upper part of a large tin funnel; which will filter off all the goods from the sediment.

39. When you are to draw a sample of goods to shew a person that has judgment in the proof, do not draw your goods into a phial to be tasted, or make experiment of the strength thereof that way, because the proof will not hold except the goods be exceeding strong; but draw the pattern of goods either into a glass from the cock, to run very small, or rather draw off a small quantity into a little pewter-pot and pour it into your glass, extending your pot as high above the glass as you can without wasting it, which makes the goods carry a better head abundantly, than if the same goods were to be put and tried in a phial.

40. When you are to buy any brandies or spirits, do not consent to take them by measure; but having tasted and tried them in a phial, insist upon having them by weight, at seven pounds three quarters to each gallon, and the stronger spirits will be lighter than what is reduced.

41. All brandies, whether French, Spanish, or English, being proof goods, will admit of one pint of liquor to each gallon, to be made up and incorporated therewith in your cask, for retail, or selling smaller quantities; and all persons that insist upon having proof goods, which not one in twenty understands, you most supply out of what goods are not so reduced, though at a higher price. For all goods which are high proof are cleaner and have a better flavour than the same goods will have when they are reduced; and the more they are brought below proof, they contract a worse relish, and are not so capable of improving by keeping, as when full proof: so that you

you must lower the proof of a lesser quantity of brandies at a time, whereby you will find your account considerable: not but the *Londoners,* who deal into the country, reduce the same commodity considerably lower, and sell at small prices; but I would dissuade you and others from that practice.

42. It is a custom amongst retailing distillers, which I have not taken notice of in this directory, to put one third or one fourth part of proof molasses brandy, proportionably to what rum they dispose of; which cannot be distinguished, but by an extraordinary palate, and does not at all lessen the body, or proof of the goods; but makes them about two shillings a gallon cheaper; and must be well mixed and incorporated together in your retailing cask; but you should keep some of the best rum, not adulterated, to please some customers, whose judgments and palates must be humoured.

43. When you have a mind to recover any goods to a better body or strength, which are too low or weak, if they be brandies, rums, or fine cordial waters, you must put a proper quantity, by little and little at a time, of spirit of wine to the goods, mixing or stirring them very well together, and often trying them, until you have perfectly restored them to the proof you desire; which may be done with little or no loss; because the spirit of wine lies you in but about the same price with the cordials, and costs less than some of your brandies. If you want to recover or amend any of your common waters, or genevas, you must put such a quantity of proof or double goods of the same kind or denomination to the other, as the price will bear, or will answer your intentions, by such a composition or mixture. If by putting proof and weak goods together, the colour or face of the goods be spoiled, which before their being mixed together were both fine, as it frequently happens, you must clear and fine them, as you do when they are newly distilled: or if you cannot stay their settling, then cast about a pound of alabaster-powder into your mixed goods, to

 stop

stop up the porous parts of the flannel sleve, which fines them immediately.

44. If by chance or accident any goods happen to be spoiled in their complexion, so as to become not saleable, as sometimes, especially in Genevas, comes to pass; or were they by some ingredients to be turned as black as ink; you must then distil them over again, only putting half the quantity of the ingredients as usual; and they will come perfectly fine as rock water from the still, and must be dulcified according to their quantity, just as they were at their first being made. But the goods, notwithstanding the misfortune they met with, will be much better than they were at their being first made.

45. As you receive so great an advantage by having your discoloured goods brought to their proper complexion again, by their being distilled a second time, as is mentioned in the foregoing paragraph; so that is balanced by the disadvantage that you lose all the dulcifying wherewith they were before sweetened; and by every distillation they are weakened near one in twenty, though improved in goodness, as aforesaid.

46. You may colour any sort of goods according to the fancies of your several customers; if your raspberries grow too pale, as they will do after their being twice or thrice drawn off and filled up with plain brandy, then a quart, or what more you find necessary, of cherry brandy must be put to the raspberry, as you make it up, to give it a deeper tincture for sale. If your plain brandy want a higher tinge, then a little burnt sugar or treacle does it immediately; and so your own judgment and experience will direct you in all the rest.

47. You will find it your interest to keep such a stock of ingredients by you, as not to be necessitated to buy in the country, where you must pay dear for them, and where you have a much worse commodity,

modity, and pay sometimes a double or triple price; because several of the ingredients are only in the hands of apothecaries, who also are seldom over-stocked therewith, and cannot, or will not, sell for a moderate gain.

48. You must be so prudent as to make a distinction of the persons you have to deal with, what goods you sell (especially fine goods, which always yield a good profit) to gentlemen for their own use who require a great deal of attendance, and as much for time of payment, you must take a considerably greater price than of others: what goods you sell to persons where you believe there is a manifest, or at least some hazard of your money, you may safely sell for something more than your common profit: what goods you sell to the poor, especially medicinally, (as many of your goods are sanative) be as compassionate as the cases require: and what goods you sell in a merchandizing way, you must have regard to the balance of trade; which you have very much in your own power, yet cannot be managed without a good correspondence abroad, and a good intelligence at home, especially about the quality and prices the goods are of, and bought at from the merchants, by whom your country chapmen are supplied; what are the contingent charges of bringing their goods home; what time of credit is given; what or how much may be supposed *per cent.* in riding, charges, and bad debts: all which must have their due weight and consideration, in your governing yourself, both in making your goods and fixing your prices.

49. What goods are most in demand, suppose Geneva, strong waters, or ordinary brandies, be sure to be therein particularly careful to keep a good stock, and have variety thereof; selling the same for a lesser profit than any other goods of equal goodness; whereby you will obtain a general credit in the place where you reside; and by lessening your profit in one thing that is observable and taken notice of, it will induce your customers to give you your own price, and a much

greater

greater gain in things that are less understood; and yield what is abundant recompence for the other.

50. You must remember that in most examples or receipts for distilling, specified in the beginning of this book, the computations of profit are made only of one charge of your still; supposed to be thirty gallons; by which you may make your own estimation in a larger or lesser quantity: and you must also note, that in some directions, about placing your still, mentioned in your fifth paragraph of this directory, respect is not always had to a still of the same guage or dimensions.

51. It is usual in shops of great business to sell all liquors for a greater dispatch by weight, to save the trouble and tediousness of measuring; who have tables hung up in their shops like almanacks, shewing at one view, the contents of any cask by its weight: which you and all distillers must or ought to be provided with, and have them hung up in frames for that purpose; as being more ready upon occasion, than any examples I can here insert. Therefore, as thinking it superfluous, I have omitted any specimen here; * but in *London* all casks for the most part under half a hogshead, are measured by such cans as are mentioned in the eleventh paragraph, which cans are as expeditious a way of measuring as by weight; though not known or used in the country; and as divers liquors are of divers weights according as they are more or less spirituous; so goods that are proof, by being reduced lower with liquor, become more ponderous; yet no allowance is made in their weight, when they retain their first names and denominations.

52. In *London,* and other southern parts, liquors retailed are sold for greater profit, than in the country; insomuch that it is a maxim taken

* A similar Table may be seen among the Distillers' Tables.

taken for granted, that the retailer has half in half profit; and oftentimes not so contented, sells in short measures, which are five quarts to a gallon; and proportionably in smaller measures; which possesses people with such a notion of the profitableness of that trade, that brandy-shops are in many places as numerous as the ale-houses; and because the distillers have an encouraging profit, it is now become customary to furnish such customers with gilded and painted casks, bottles, brass cocks, &c. at the distillers' charge; he reserving the property, and setting his own name thereon; which is also designed as an obligation to continue their custom: but the way which has of late obtained, of having dead stock in hand, which is seldom cleared off, is much worse than taking by smaller parcels, and paying ready money for what they have.

53. In the country liquid measures somewhat differ in name, but not in substance from what they are in *London*; where they are called gallons, quarts, pints, half-pints, quarterns, and half-quarterns: but in the country they are termed gallons, quarts, pints, jills, half-jills, quarter-jills, &c. And one thing is observable here which is not any where taken notice of, *viz.* that by the city standard, four quarts over-run the gallon, by about one and a half quarter pint; two pints over-run a quart proportionably; two half-pints over-run a pint; two quarterns overflow one half-pint, and two half-quarterns exceed one quartern in the like proportion; and they are sold accordingly, *viz.* one gallon, one shilling and ten pence; one quart six pence; one pint three pence half-penny; one half-pint, two pence; one quartern a penny half-penny; and one half-quartern three farthings.

54. When you scald out, or season any vessel with hot liquors out of the still, take care not to put any aniseed hot-wash into any other vessel than aniseed-water: for it will leave behind it a disagreeable relish, and gives the goods an ill flavour: but the hot-wash of other goods, such as Geneva rectified, all-fours, clove, &c. leave no ill scent behind,

behind, in what cask soever they are put; you must also take care not to put white goods, such as Geneva, brandies, and most sorts of strong waters, in any casks that have had red liquors in, such as clove-waters, cherry-brandy, &c. unless you first scald out such casks three or four times with hot wash or liquor, to fetch out the tinge of the red colour, which is not effected without great difficulty; and therefore must be very cautiously observed.

You are to be perfectly versed *(ad unguem)* in weights and measures, *viz.* twenty hundred weight is a tun, one hundred and twelve pounds is an hundred weight, twenty eight pounds is a quarter of an hundred weight, sixteen ounces is one pound; lower than which you need not go: so also one tun of liquors weighs about twenty hundred weight, and consists of four hogsheads containing sixty three gallons; one gallon of strong waters or vinegar weighs eight pounds; one gallon of proof-brandy or spirits weighs seven pounds three quarters; one gallon of oil weighs seven pounds and an half; and one gallon of treacle, or honey of a good consistence, is ten pounds and an half (and sometimes twelve pounds is allowed in honey to the gallon): and an hundred weight is abbreviated in writing by this character C. a quarter of an hundred by Q. and a pound weight is expressed by lb; and an ounce weight by oz. or G.; and so for a gallon you may write Gall. for a Quart, Qt. for a Pint, Pt. and for a Jill, Jil, &c.

It may not here be improper to insert some certain rules observed by distillers in drawing off and making up their distilled goods: *viz.* when you perceive about two-third parts of the first quantity you put into your still is come off, then be often trying your goods in a glass

or

or phial; and when you see that the bell, or proof, immediately falls down, and does not continue a pretty space upon the surface, then take away the can of goods, and substitute another vessel to receive the feints; which, if suffered to run among the goods, would cause a disagreeable relish, and be longer in fining down; whereas the feints being kept separate, the goods will be clean and well-tasted, when made up with liquor to their due quantity.

It will much improve your goods (and is used by most distillers) to throw into your still along with your goods, when first charged, about six ounces of bay salt to every ten gallons of spirits; and so proportionably, more or less, to a greater or lesser quantity of spirits; whereby the goods will better cleanse themselves and separate from their phlegmatic parts; and the spirits so dephlegmated will ascend and come over much cleaner and finer in distillation.

Some also are wont to cast in a handful of grains, to make the goods feel hot upon the palate, as if they bore a better body; yet this conduces nothing towards the advancement of the proof, when the goods come to be tried in a glass. *See False Proof.*

When your goods are all come off, and you design them for double goods, you must make them up to their first quantity with liquor; as if, for instance, you charged your still with three gallons of proof-spirits, they will yield in distillation about two gallons without feints; which deficiency of one gallon must be made up with liquor (and sugar used in dulcifying) to their determined quantity. And if you are to make up your common or single goods, you must add over and above the prescribed quantity in compounding double goods, one and an half part more of liquor, (*viz.* one gallon and an half) to dilute it for single or common goods. Thus, by this specimen, you may learn how to make goods proof, and how to reduce them lower

to

to what strength or body you please, according as use, or the custom of the place has rendered them more or less vendible.

You must also observe when you dulcify your goods, that you never put your dissolved sugar amongst your new distilled goods, till the said dulcifying be perfectly cold, for if mixed hot with the goods, it would cause some of the spirits to exhale, and render the whole more foul and phlegmatic than otherwise they would be.

When you want to fine any goods speedily for present use or sale, (especially white or pale goods) add about two drachms of crude alum, finely powdered, to three gallons of goods; which rummage well therein, and it will immediately depurate, or throw down the fæces, whereby the residue will become clear and transparent for sale or use.

These observations so useful and necessary to distilling, I could not omit; but thought good to insert them all under one general head; as designing in the following treatise, to touch upon this subject no farther.

My principal intention being to render this treatise useful to all, I have endeavoured to deliver every thing in the plainest and most intelligible manner. Beauty of style is not, indeed, to be expected in a work of this nature; and, therefore, if perspicuity be not wanting, I presume the reader will forgive me where he has met with some passages that might have been delivered in a more elegant manner. I have also, for the same reason, avoided, as much as possible, terms of art, and given all the recipes in words at length.

Distillation, though long practised, has not been carried to the degree of perfection that might reasonably have been expected. Nor will this appear surprising, if it be considered that the generality of

distillers

distillers proceed in the same beaten track, without hardly suspecting their art capable of improvements, or giving themselves any trouble to enquire into the rationale of the several processes they daily perform. They imagine that the theory of distillation is very abstruse, and above the reach of common capacities; or, at least that it requires a long and very assiduous study to comprehend it; and, therefore, content themselves with repeating the processes, without the least variation. This opinion, however ridiculous it may appear to those not acquainted with the present practice of distillers, has, I am satisfied, been the principal cause why distillation has not been carried to the height it would otherwise have been. I have, therefore, endeavoured in the preceding Treatise, to destroy this idle opinion, and shew the distiller how he may proceed on rational principles, and direct his enquiries in such a manner as cannot fail of leading him to such discoveries as may be attended with advantage both to himself and his country.

Here is subjoined the genuine Process of preparing HOLLANDS GIN, *agreeable to the Practice of the best Dutch Distillers.*

BREWING FOR HOLLANDS GIN.

THEIR GRIST is composed of ten quarters of malt, ground considerably finer than our malt distillers' barley grist, and three quarters of rye-meal; or, more frequently, of ten quarters of rye and three quarters of malt-meal. The ten quarters are *first mashed* with the least quantity of cold water it is possible to blend it up with; when

 uniformly

uniformly incorporated, as much boiling water is added as forms it into a thin batter; it is then put into one, two, or more casks, or gyle tuns, with a much less quantity of yeast than is usually employed by our own distillers. Generally on the third day they add the malt or rye meal, previously made into a kind of *lob*, prepared in a similar manner, except in not being so dilute; but not before it comes to the temperature of the fermenting wash; at the same time adding full as much yeast as when at first *setting the backs.*

The principal secret in the management of the mashing part of the business is, in first thoroughly mixing the malt with the cold water, and in subsequently adding the due proportion of boiling water, that it may still remain sufficiently dilute after the addition of the fine meal, under the form of lob, and in well rousing all together in the back, that the wash may yet be dilute enough for distilling, without endangering its burning to the bottom of the still. Thus they commodiously reduce the business of brewing and fermenting to one operation. By using cold water to uniformly wet the malt, all danger of clogging the spending of the tap would be necessarily avoided; but here, there is no occasion to do any thing more, than sufficiently dilute the wash, consisting of the whole of the grain, thin enough to be fermented and distilled together, by which means the spirit of the bran and husky part, as well as of the flour of the grain, are completely extracted, yet their wash, compared to ours, is about three-eighths thinner. For these reasons, they obtain more spirit from their grain than we do, and of a better quality, with not half the trouble taken by our distiller. Their backs usually contain as much wash as serves for one distillation. The gravity of the distillers' wash at *Weesoppe*, in the neighbourhood of Amsterdam, in 1774, weighed but eighteen pounds per barrel, very little more than half the gravity of ours. Their stills usually are from three to five hundred gallons each; they constantly draw off three cans of phlegm, after the runnings cease to burn on the head of the still, when distilling wash;

wash; and five cans when distilling *low wines*; a practice we are unacquainted with, we usually drawing our fire as soon as the runnings from the still burn languidly on the still-head. This, and the great quantity of rye they use, causes their spirit to be so much more acid; and the diluteness of their wash is a very good reason for the greater purity of their spirit; though most writers mistakenly say, our spirit is much cleaner.

RECTIFICATION INTO HOLLANDS GIN.

To every twenty gallons of spirits of the second extraction, about the strength of proof spirit, take three pounds of juniper-berries, and two ounces of oil of juniper, and distil with a slow fire until the feints begin to rise, then change the receiving can; this produces the best *Rotterdam Gin.* An inferior kind is made with a still less proportion of berries, sweet fennel seeds, and Strasburgh turpentine, without a drop of *juniper-oil.* It, and a better sort, but inferior to the Rotterdam Gin, are made at *Weesoppe.* The distillers' wash at *Scheedam* and *Rotterdam* are still lighter than at *Weesoppe,* where there were about three hundred distillers when I was there in 1774. Strasburgh turpentine is of a yellowish brown colour, and very fragrant agreeable smell; its taste is the bitterest, yet the least acrid of the turpentines. The juniper-berries are so very cheap in Holland, that they must have more reasons than mere cheapness for being so much more sparing of their consumption than our distillers. Indeed, they are not in the habit of wasting any thing; I have always observed, that they are not so prone to over-doing their compound spirituous liquors as the distillers of the United Kingdoms. *See comparative Observations on malted and unmalted Corn.*

A PURE

A PURE FLAVOURLESS SPIRIT FROM POTATOES.

There are several other vegetables of the edible kind which afford saccharine matter, as Skirrots, Carrots, Parsneps, Beet-roots, &c. These are often so plenty as to be manufactured to advantage, particularly when *bread corn* is low or even at a moderate price, or they may be advantageously sown or planted for the purpose on wild and waste lands. With respect to any other plants found out by philosophical men, and recommended for the purpose, with a vew to save grain and edible plants for the purposes of life, before any considerable expence is incurred, it may be necessary to make an experiment for ascertaining the quantity of saccharine matters they contain, in order that an estimate may be made to compute the amount of the incidental expence of *materials* and *labour*. This is done by making a tincture of the vegetable to be assayed in *rectified spirits of wine,* which, when saturated by heat, will deposit the sugar upon standing in the cold.

Potatoes are best in the spring for this purpose, as they begin then to vegetate. This is often promoted in the winter, by housing them in large heaps. The vegetation is curbed, as in malt of barley, or other grain, by laying them thin, and by subsequent drying, by which they lose their aqueous part, or water, and may be ground into meal for brewing. This is best performed by making the meal or flour of the potatoes into a thin paste, or very thick batter with cold water, and diluting it with boiling water, suffering it to cool, as in brewing with other matters, and fermenting it like them. *See Brewing for Distilling;* and so proceeding to draw the spirits of the first and second extraction. All other roots and plants are to be managed in much the same manner to prepare an ardent spirit from.

ON

ON FERMENTS.

They are the necessary additions to promote excited fermentation. Over and above what has been said in different parts of the work, I beg leave to subjoin some observations from M. I. A. Chaptal, vol. III. p. 240. The conditions necessary for the establishment of fermentation are—1. The contact of pure air.* 2. A certain degree of heat. 3. A quantity of water, more or less considerable, which produces a difference in the effects. The Phœnomena which essentially accompanies fermentation are—1. The production of heat. 2. The absorption of oxygen gas. Fermentation may be assisted—1. By increasing the mass of fermentable matter. 2. By using a proper leaven, or ferment—1. By increasing the fermentable mass, the principles on which the air must act are multiplied, consequently the action of this element is facilitated; the more heat is produced by the fixation of a greater quantity of air; and consequently the fermentation is promoted by the two causes which most eminently maintain it, *heat* and *air*. 2. Two kinds of leaven may be distinguished. 1. Bodies eminently putrescible, the addition of which hastens fermentation.*****2. Those which eminently abound with oxygen, and which consequently afford a greater quantity of this principle of fermentation. And on this account it is, that the acids, neutral salts, and metallic calces hasten fermentation. The products of fermentation have caused different species to be distinguished; but this variety of effects depends on a variety of principles in the vegetable. When the *Saccharine* principle predominates, the result of the fermentation is a spirituous liquor; when, on the contrary, the *Mucilage* is the most abundant, the product is acid; if the *gluten* be one of the principles of the vegetable, there will be a production of ammonic in the fermentation; so that the same fermentable mass may undergo different alterations, which always depends on the nature and respective

* Or generation of pure air, which comes from the water of fluidity.

spective properties of the constituent principles, the susceptibility of change &c. Thus a saccharine liquid, after having undergone the spirituous fermentation, may (as frequently before observed) be subjected to the acid fermentation, by the decomposition of the mucilage which had resisted the first fermentation; but in all cases the concourse of air, water, and heat is necessary to develop fermentation.

FERMENTATION WITHOUT YEAST.

In the Memoirs of the Manchester Society, Mr. *Henry* gives an account of some experiments, in which he produced fermentation, not only in *bread* and *wort*, but in liquors that might be thought incapable of it, *viz.* punch and whey, by means of fixed air.* Having previously suspected, from some observations and experiments, that yeast was only a quantity of fixed air, involved and detained among the mucilaginous parts of the fermenting liquor, he attempted to prepare it in the following manner: Having boiled wheat-flour to the consistence of a thin jelly, he put this viscous fluid into the middle part of Dr. Nooth's machine for impregnating water with fixed air; the gas was absorbed in considerable quantity; and the next day the matter was in a state of fermentation; the third day it had acquired so much the appearance of yeast, that an experiment was made on some paste for bread; and after five or six hours baking it was found to have answered the purpose tolerably well. Another experiment was made with *wort;* but here the artificial yeast was not made use of. Instead of this, part of the wort itself was put into Dr. Nooth's machine, and impregnated with fixed air, of which it imbibed a large quantity; on being poured into the remainder of the liquor, a brisk fermentation

* See Lavoisier on the acetous acid; water converted to vinegar by impregnating it with fixed air from the fermentation of a vinous liquor.

fermentation came on in twenty-four hours; a strong head of yeast began to collect on its surface; and on the third day it seemed fit for tunning. In prosecuting the experiment, good bread was made with the yeast taken off from the surface; and beer was produced by keeping the fermented liquor; and good ardent spirit by distilling it. In another experiment, in which a fourth part of the *wort* was impregnated, but not saturated with fixed air, the fermentation did not commence so soon, though it is probable it would also have taken place at last without any further addition. The experiment commenced about midnight; but in the morning there were no signs of fermentation; at five in the afternoon there was only a slight *mantling* on the surface; a bottle, with a perforated stopper and valve, containing an effervescing mixture of chalk and acid of vitriol, was then let down into the bottom of the vessel; the discharge of fixed air from this mixture was going on rapidly at nine o'clock, while the liquor at the same time seemed to be in a state of effervescence; at eleven o'clock the bottle was withdrawn, as the fermentation was commenced beyond a doubt, the liquor having a pretty strong head of yeast upon it; next day the fermentation seemed to be on the decline, but was recovered by a second immersion of the bottle and mixture. When the vinous fermentation was finished, the liquor, by being kept too long, was found converted into vinegar; so that, in the course of these experiments, ale, bread, yeast, ardent spirit, and vinegar, had all been produced.

M. Lavoisier's application of fixed air, and his analysis of yeast, authorised Mr. Henry's conjecture of fixed air. His experiments are interesting, and the results what he had a right to expect; in my opinion, the experiments made with a view to controvert them, serve to support them; though they were, no doubt, undertaken by Dr. Pennington with the laudable motive of adding to the common stock of facts; which they certainly do, by bringing a greater number of these facts into one point of view. There are many tons weight of this

this elastic air, blended with some tons of alkohol, dissipated in great breweries, distilleries, &c. and annually every vintage in wine countries, that may, no doubt, be one day or other converted to useful purposes, highly advantageous in undertakings of this kind; which may be gathered from observations dispersed through this work.

End of Book II.

MALT DISTILLERS' TABLE, No. I.

Particularising the Produce of a Brewing of from Ninety to One Hundred Quarters of Grain, with a View to obtain from One Thousand Six Hundred and Twenty, to One Thousand Eight Hundred Gallons of Spirit, at One to Ten over Proof; that is, of such a Strength, that Ten Gallons of Spirit will take One Gallon of Liquor to make it up to Hydrometer Proof, which consists of Fifty-five Parts of highly rectified Alkohol and Forty-five of Liquor, (i. e. Water).

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.		15.		16.		17.		18.		19.		20.		21.		22.	23.	24.	25.	26.	27.	28.
Date and Number.	Quarters of Grain.	Barrels of Liquor.	Heat of Liquor.	Time of Mashing.	Standing of the Tap	Length drawn in Barrels.	Gravity of Worts in the Cooler.	Fermentable Matter in Pounds.	Barrels of Lob.	Temperature at Pitching.	Stores of Yeast.	Gravity of the Wash in the Back.	Attenuation.		Attenuation and Rousing.		Attenuation.		Attenuation.		Attenuation.		Attenuation and Cutting.		Attenuation.		Attenuation & Gravity when finished.		Wash in Gallons.	Low Wines.	Spirit.	Feints.	Feints returned.	Returns in Barrels of Worts, the 4th Mash.	Remarks.
													First Day.	Second Day.	Third Day.	Fourth Day.	Fifth Day.	Sixth Day.	Seventh Day.	Eighth Day.	Ninth Day.	Tenth Day.	Eleventh Day.	Twelfth Day.	Thirteenth Day.	Fourteenth Day.	Fifteenth Day.	Sixteenth Day.							
Mar.	Qr.	Bar.	Deg.	H. M.	H. M.	Bar.	lb.	lb.	Bar.	Deg.	No.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	Gall.	Gall.	Gall.	Gall.	Gall.	Bar.	
1st.	90	174	130	1 0	1 0	80	33	2640																											
2nd.	...	143	160	1 0	1 30	91	26	2366																											
3d	...	123	190	0 50	1 30	103	16	1648																											
4th.	Carried	down.																																	
		440	...	...	...	276	75	6654																											
		276		Barrels	of Lob.	34	...	900																											
Liquor absorb	ed ...	164	160	Mean	of the	Heats.																													
Brot. down	...	100	...	0 40	1 30	300	9	981	...	62	10	34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	108	
2nd.	10	...	...	...	...	...	...	...	34	...	...	...	32																						
3d.	...	...	...	...	...	...	...	...	...	...	...	...	...	29																					
4th.	...	...	...	...	...	...	...	...	...	...	10	...	...	...	28																				
5th.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	26																				
6th.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	25																			
7th.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	19																		
8th.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	17																	
9th.	10th.	11th.	12th.	13th.	14th.	15th.	...	...	...	...	10	...	...	...	...	...	...	...	16	14	13	12	10	9	7	6	5	5							
10th.	Pumpe	d into	theStill																																
Mean	of the 100	Heats. 474	160 ...	3 30	5 30	300	84	8635	34	62	30	34	32	29	26	25	19	17	16	14	13	12	10	9	7	6	5	5	11,000	~~7,384~~ 3000	1,816	154	...	108	

Notwithstanding each Column may be sufficiently understood by its respective denomination placed at the top of each, yet, to prevent any of them being miscomprehended, I will here give a concise explanation of them Column the 1st, contains the Date of the Month and Number of mashings. Column the 2d, the Number of Quarters of Grain wet. The 3d, the Number of Barrels of Liquor turned over. The 4th, the Heats of the Liquor. The 5th, the Time of mashing. The 6th, the standing of the Tap, or Time the Liquor stands on the Goods each mashing. The 7th, the Length, or Number of Barrels of Worts drawn, or extracted from the Goods. The 8th, the Gravity of the Worts in the Coolers. The 9th, the fermentable Matter obtained from the Goods. The 10th, the Barrels of Lob finally added to complete the Wash. The 11th, the Temperature of the Wash at pitching. The 12th, the Number of Stores of Yeast employed. The 13th, the Gravity of the Wash brought together and pitched in the Backs, or *Attenuation* during the *Fermentation*, occupying the 14th, 15th, 16th, 17th, 18th, 19th, 20th, and 21st, Columns. The 22d, The Number of Gallons of Wash. The 23d, the Number of Gallons of Low Wines. The 24th, the Number of Gallons of Spirits obtained. The 25th, Gallons of Feints made. The 26th, Gallons of Feints returned into the Still with the Wash of the next brewing. The 27th, the Number of Barrels of the fourth Mash reserved to use instead of so much Liquor at the next brewing, they usually containing a considerable quantity of fermentable Matter.
The 28th Column, Remarks, or Observations noted during the Process.

MALT DISTILLERS' TABLE, No. II.

1. Date and Number.	2. Quarters of Grain.	3. Barrels of Liquor.	4. Heat of Liquor.	5. Time of Mashing.	6. Standing of the Tap.	7. Length drawn in Barrels.	8. Comparative Gra... Coolers.	9. Fermentable Matter in Pounds.	10. Barrels of Lob.	11. Temperature at Pitching.	12. Stores of Yeast.	13. Gravity of the Wash in the Back.	14. Attenuation.	15. Gallons of Wash.	16. Low Wines.	17. Spirit.	18. Feints made.	19. Feints returned.	20. Returns of Barrels of Worts.	21. Remarks.
	Qr.	Bar.	Deg.	H. M.	H. M.	Bar.		lb.	Bar.	Deg.	No.	lb.		Gall.	Gall.	Gall.	Gall.	Gall.	Bar.	
March 1st.	80	150	170	1 0	1 0	57		2337												
2nd.	...	120	125	1 50	1 0	63		2258												
3d.	...	130	198	1 0	1 30	105	2	2625												
		440	...	...	...	225	.	7220												
Carried	down	the 4th	Mash.																	
		125	3-493	164⅔	Mean	of the	Hea													
Liquor absorb	ed ...	175																		
	10	30	180	...	...	30	3(	1234	30	Barrels	of Lob									
						255	..	8454												
	Evapor	ation	deduct	ed ...	...	28½														
						226½	Barrels	Gallons	...	...	...	...	... ...	8167½						
								Pitched at	10o'Clock	61	10	32								
March	11th,	12th, &	14th.	...	...	...	...	...	...	...	...	...	29lb. 27lb. 24lb. 21lb.							
15th.	Roused	with	seven	store of	Yeast	...	...	...	...	...	7	...	20lb.							
16th,	17th,	18th,	...	...	...	...	...	...	...	...	...	...	18lb. 16lb. 12lb.							
19th,	Cut	with	five sto	re of	Yeast	...	...	...	...	...	5	...	9lb.							
20th.	Flour	and Sa	lt, add	ed, the	Back	not fit,	closed	...	...	...	...	...	8lb.							
21st. to	the	25th,	added	Yeast	and cl	osed up	...	...	...	...	3	...	8lb.							
25th.	Exami	ned, &	found	it com	plete	...	...	...	...	...	...	...	4lb.							
26th.	Distill	ed the	Wash	...	...	...	...	...	...	...	...	4	4lb. Unattenuated, pumped	into Still.	2700	...	...	130		
27th.	Doubl	ed, or	distille	d the	Low	Wines	into Spi	and made	it up at	one to	ten over	Proof	... ...	...	...	1850				
Carried down the 4th	Mash	100	120	0 30	1 40	105	8	840	Reserved	to be	turned	over	the next Brewing. ...	...	...	...	...	...	105	
Take Mean of	the Gr the	avity Heats	in the 164⅔	Still, fr	om the	Gravit	y in the	Coolers,	or at pitc	hing in	the Bac	ks, and	there Remains 28lb. per	Barrel atte	nuated.					
	90	...	...	4 20	4 10	226½	36	8454	30	61	25	36	... 28	8167½	2700	1850	148	130	105	

For the Explanation of this Table, see Malt Distillers' Table, No 1. For further Illustration, see the Plate of the Distillers' Back-room.

BOOK THE THIRD.

THE PREPARATION

OF

WINES, VINEGARS, &c.

SIDNEY, Printer, Northumberland Street, Strand.

THE ORDER OF PROCEEDING

IN THE

WINE AND VINEGAR OFFICES.

MADE WINES, OR SWEETS.

LET it be first considered the wine you intend to make; (that is, the foreign wine you mean to imitate) secondly, whether it is to be a small or strong, red, white, or sharp; a sweet or dry, thin or full, wine.

In my apprehension all these various changes, and many more, into which they may be further subdivided or enumerated, are producible from raisins, sundry fruits, molasses, sugar, honey, cyder, malt, tartar, and lees of wine; together with the colouring, flavouring, and fining, ingredients.

But to perform all this, a perfect knowledge of fermentation, throughout all its various stages, will be indispensibly necessary,* and an excellent palate, or just taste: for on the first depends the possibility of making good and wholesome wines, and of obtaining,

 without

* Which may be collected from the two former Books, and the subsequent Appendix on Wines, Brandies, and Vinegars.

without loss or waste, the full produce. And on the second, the success of the just imitation of flavour, in giving it that characteristic scent and flavour, distinguishable by every palate; for without this relish, the most wholesome and rich *made wines* are immediately discoverd; and though they were ten times better than the foreign, still they are drank with loathing and disgust, by those who have not a sufficient knowledge of the foreign wine imitated, to distinguish and do credit to the operator. Such is the depravity of taste formed without judgment, and the infatuation of deep-rooted prejudice.

There is one observation that I have made, the justness of which must strik every one, who has been concernd in imitations of flavour; and that is, the universal, and in some degree almost unavoidable error of over doing; an error that I never knew any distiller or wine-maker totally free from. Hence it is not enough to know what will give the desired flavour, and the usual quantity; but the time when and how to add it, as it is that must produce the desired effect, and regulate the quantity; circumstances that intirely depend upon fermentation, taste, and the utmost caution not to over do the business.

With regard to fermentation, wines may be divided into three classes; those of the first do not indeed deserve the name of wines; as having scarcely suffered any degree of fermentation at all, and being no other than boiled Must; of this kind are several of the Italian wines, (and most of our own made for private use.) The Italians call these wines *Vino-cotto*, that is boiled wine.

'Tis to thin watery juices, extremely prone to ferment, and in which fermentation when once begun, can scarcely be prevented until run beyond the vinous state, to which this process is applyed; by boiling, the fermentive quality is restrained and the liquor becomes richer

richer and continues fit for drinking at least a year or two, though it is never so wholesome as fermented wines.

The second class comprehends those wines which have undergone fermentation, but not a complete one, (of this kind are the best of our own made wines). Abroad there are two kinds: the first are thin sweet wines, which are no other than Must, partially fermented, or whose fermentation is checked, while it can be checked, before the sweetness has gone off; these wines do not keep well above a year: such are the Tyrol, and some of the Savoy, and several of the Italian.

The second sort is strong, full-bodied, rich, sweet, wines, which are generally a mixture of fermented and inspissated Must, the latter being added to increase the richness of the liquor, * and prevent the fermentation running beyond its due limits. These kind of wines greatly heat the constitution, and ought to be sparingly drank. Such are Malmsey, Canary, and Malaga, and the richest kind of Frontiniac, and some Hungarian wines.

To the third class belongs those wines that have been completely fermented, and have thrown off their gross matter; these are the most perfect wines, and for common use the most wholesome; as Burgundy, Hock, Claret, old Port, and some other red wines, with a few small white wines, as Calcavella, small Frontiniac, &c. and particularly Rhenish.

FLAVOURING.

* In some cases they should be added at, or nearly at, the close of the fermentation.

FLAVOURING.

With regard to flavouring ingredients, that partly depends upon the manner of preparation, and partly upon the additions during, or towards the close of, the fermentation; a flavour never intended, is too often owing to the ferment employed; and often, to the great disappointment of the vintager or vintner, a compound flavour is produced, partaking of the flavouring ingredients added, and the ferment employed.

The principles of which wine consist, are, an inflammable spirit, a phlegm or water, an acid salt or tartar, and a sulphurious oily substance. Wines, therefore, greatly differ in taste, smell, and body, according to the various proportions and manner in which these principles are combined. There are in some wines another principle, which is a soft, oily, mild, viscid, sweet, substance, particularly observable in Sack, rich Frontiniac, and the more generous kinds of Hungarian wine; which owe their flavour, taste, colour, and body, to the manner of gathering, pressing, fermenting, &c. more than to any difference in the grape itself.

In the preparation of their Tokay, and some of the richest, and highest flavoured wines, they are extremely curious in these respects; for their prime and most delicate flavoured wines, the grape is suffered to continue upon the vine till half dried by the heat of the sun; and if the sun's heat should not prove sufficient, they are dried by the gentle heat of a furnace, and then carefully picked from the stalks. The juice of this grape, when pressed out, is of a fine flavour, and sweet as sugar; this, after due fermentation, is kept for a year, and then racked from the lees, when it proves a generous oily wine, and is sold at a very high rate.

The

The Hungarians prepare a second kind of wine, by collecting together the better kind of grapes, carefully picking the fruit from the stalks, and then pressing out the juice; this is extremely sweet, and is made richer by infusing in it, after it has fermented for some days, a sufficient quantity of half-dried grapes. This wine is very sweet, oily, of a grateful taste, and retains these qualities for a long time. There is a third sort made from the pure juice of the same kind of grape, without any additions; this is a more brisk and lively wine, and far less sweet. They likewise prepare a fourth sort, from the grapes as gathered mixed together; this, though not so generous, is nevertheless extremely good wine.

These Hungarian wines are remarkable for perserving their sweetness and delicacy of flavour for a long time, and do not grow easily vapid.

This practice of the Hungarians which I have extracted from Hoffman's Observations; fairly points out a method of improving the juice of the grape to any assignable degree of strength, or richness.

Red wines owe their colour to the skins of the grape, and this in proportion to the time they are allowed to stand upon them; this circumstance contributes to their roughness or astringency, which they not only extract from the skin, but also from the stones, (observe 'tis only a dilute red colour that is obtainable in this manner, the deep or high colourd wines of France, Portugal, &c. are colourd by colouring ingredients, and by a mixture of the Portugal *Vino-tino*) *Rhenish* and Hungarian wines yield a far more delicate and subtile flavoured spirit, than the wines of France and Misnia: the very smell of good old Rhenish wine has a remarkable effect in refreshing the spirits. Nor is the acid principle, or *tartar,* less different in wines; some abound with it, while others have it more sparingly, but of a more subtile kind, as Rhenish wines: the tartar of some wines, particularly that of Moselle,

Moselle, has a bitterish nitrous taste; whence they are held to be laxative and diuretic.

Most of the Spanish wines are composed of fermented or half fermented wine, mixed with inspissated Must and variously manufactured, and of infused dry grapes in weak Must.

No wines freeze more difficultly than the Spanish, they abounding with unctuous matter, and inflammable spirit.

By attending to these circumstances we are led to imitate them, and may be further encouraged from our having the same materials. Spanish grapes (raisins) and Portugal sugars.

The juice of the grape is called Must before its fermentation; different sorts of Must are obtained from the same kind of grape, produced in the same vineyard, according to the method of management; the best is that which issues upon breaking, brusing, or treading the picked fruit; inferior sorts are obtained by forcably pressing the intire cluster, stalks and all.

Dilute watery Musts are enriched by infusing in them dried grapes; and by inspissating part of the liquor, and adding it to the rest; by these methods strong-bodied wines are obtainable from the poorest juices; and by similar management, even the better sort of grape-wines are imitable with the juices of other fruits and raisins, artificially concentrated, or heightened with syrups, or the simple sweets of sugar, of honey, &c.

In some places the grape is concentrated, or rendered richer, by suffering it to remain on the tree till great part of its watery moisture is exhaled, the stem of each cluster being cut half through when the fruit is ripe, or twisted, to prevent the afflux of any fresh juice from the

the plant. The sweet Hungarian, and the sweet Spanish wines, are made from grapes prepared in this manner.

IMITATIONS.

Weak wines are improved by the addition of spirit before the fermentation is completed, as the poor are enriched by sweets. Even the most delicious wines have been imitated without a drop of the juice of any kind of grape but what is drawn from the dried grape, or raisins; with dry currants, figs, and the juices of ripe fruits, &c.; more particularly with regard to flavouring ingredients. Clary-flowers with sweets, Malmsey, with *Rhenish-tartar* and Rhenish-lees. A spirit drawn from clary, with rich sweets highly tinctured with clary-flowers, Canary sack.

Elder-flowers, with tartar of Moselle wine, or white tartar, and a small quantity of salt-petre, Moselle. Sweets, completely fermented with bramble-berries and barberries, make Claret. *N. B.* The tartness may be helped with red tartar and the acid of tartar, *(see acid of tartar)* and with the lees of Claret. The colour, by a mixed tincture of Brazille and logwood. The berries should be added at or about the close of the fermentation.

Sloes, with a very small admixture of buckthorn-berries, added to sweets towards the completion of the fermentation, Port. *N. B.* The strength is given by a pure tastless spirit, drawn from fermented sweets; or genuine brandy, cyder, &c. The colour, with logwood and red saunders. The spirit is to be added after the sloes, to prevent an acetous fermentation. Tartar may be sparingly added here, when found necessary. Syrup of white currants gives to a light, brisk, well-fermented sweet, the flavour of Frontiniac;* and to a richer,

 fuller

* This wine must be racked off and bottled before the cessation of the fermentation.

fuller bodied sweet, tolerably well fermented, the flavour of Champaign. * Indeed they will both resemble different kinds of Frontiniac more than Champaign. † Syrup of strawberries in a large proportion, with a rich, dry, well fermented sweet, Sherry, in which almond cake must be infused. Mountain Malaga is best imitated by a rich syrup, partly dry and sweet, but partially fermented, drawn from the best kind of raisins, sugar, or molasses; as must the basis of all the best white wines.

Burnt sugar gives a fine amber colour, from the lightest shade to the deepness of old brandy; oak-chips the same, and also an astringency. Yellow saunders, a fine citron colour, and a grateful aromatic scent. Sassafras, a strawberry colour, and fine aromatic but peculiar scent. Red saunders, Brazille, and logwood, red and purplish red, with a sweet, subastringent taste, particularly the last: to these colouring ingredients we may add turnsole, cochineal, mulberries, elder-berries, bramble-berries, barberries, &c. To the flavouring, the outer rhinds of orange and lemon peel, peaches, apricots, and nectrines, but above all, accassia, terra Japonica, pomegranite, &c. Many wines can be imitated, or rather the imitation admirably helped, by very slight impregnations of all the spices, many of the aromatic seeds, and some of the aromatic woods, barks, and roots; as for instance, Neumann relates, that as much powdered nutmeg as would lay on the point of a knife, if added at the close of the fermentation, would give a sensible flavour to a large vat of beer. But of these more hereafter. Having thus enumerated part of the stock of materials that you are to draw your wine from, and with which you are to give them flavour, scent, and colour; previous to a particularization of each process, I shall make some primary observations in the general way, and then return to the fermentation, which must be considered and allowed as the ground-work of the whole.

Having

* As must this, with the addition of *fixed air*. See the preceding note.

† If fixed air is not added during the fermentation.

Having considered the wine you purpose making, procure a stock of the materials most fit for that purpose; for instance, if they be Spanish wines you intend to imitate; get Spanish fruit and Spanish tartar, and if possible, a sufficient quantity of fresh lees of the same wine, which lees you are to procure from the wine-cooper, or wine-merchant. If German wine, German tartar, and best Spanish fruit, with lees, &c. If French wine, French fruit, tartar, and lees. And so of the Portugal, Italian, &c. &c. *N. B.* That you are never to use any other ferment but fresh or dried lees of the wine you intend to imitate; in default of these, their tartar or argol.

If we are inclined thoroughly to investigate the Doctrine of Fermentation, we must be guided by no theory; we must attend to Nature herself, and trace her through all her instructive windings: it is hypothetical reasoning, not nature, that misleads mankind in general; he is seldom wrong that resorts to her for instruction; she does not bias with specious but falacious reasoning.

But for further illustration of this matter, let us behold the grape in its first stage of growth. Sour, styptic, and ungrateful to the taste; its earthy or fibrous parts having not received strength or heat enough to draw forth its sulphureous oily particles, to sheath, as it were, this crude austerity; when it has received a greater draught of nutritious sap, assending from the root, as from a fountain in a constant stream, attracted upwards, rarified, and matured, by the solar heat, it encreases in magnitude, substance, and flavour, supplyed by its bounteous parent, Nature, until it is ready to burst with exuberance: during all this time the acid austerity is gradually obtunded (not destroyd) by the exaltation of the oleagenous sulphureous particles, gathering strength with age, and combining with the acid, and as it were by its superiority, assimilating it to itself, until that combined flavour is produced, that distinguishes it from all other fruits, by a delicacy found only in the

grape when ripe. A kind of vegetative fermentation that produces all the variety of asture, sour, and sweet.

And through which stages we shall presently find it as regularly return when under that operation, properly called fermentation. We have already seen that this sweetness is encreased by suffering them to stand when ripe, and by artificial means, as by cutting the stem of each branch half through, or twisting them, and thereby causing a partial interception of the current of sap, which would otherwise destroy the intention, by over loading and bursting the fruit, or by impoverishing the juice that was intended to be concentrated; which it effectually does, by the sun's vital heat evaporating the superfluous moisture or phlegm, and leaving the fruit more unctuous, sweet, and balsamic, and with less danger of spoiling, or running into a putrid fermentation, than when cut down from the tree; but however disposed the juices of the watery and poorer kind of grapes, or even the rich may be, to run into a putrid fermentescence, if not duly guarded against; they never run into a vinous fermentation until expressed from the fruit; in which state they are called Must, which, by breaking the fibres of the vessels, changes the disposition of the parts, and is constantly attended with a fermentation more or less violent, which produces wine; and which is brought about by the acid tartarous salt, being set at liberty, by the intestine motion, which laying hold on the oily particles, by its subalkaline quality, partially rarifies, and partially unites, with the oil of the plant, and the more subtile parts of the earthy particles, depositing the grosser in two substances, the one in form of lees to the bottom, and the other in tartar to the sides of the containing vessel, leaving the supernatant fluid cleansed and clear, of a spirituous, pungent, subastringent, taste, covered or blended with more or less of a soft grateful sweet, in proportion to the richness of the fruit, the additions made use of, and the management of the fermentation, by which it appears, that the spirituous parts of the grape are not visible, or rather do not exist, until a resolution and

and subsequent combination of its parts are brought about by fermentation.

For Must is a sweet liquor that neither sends spirits to the head to intoxicate, though drank never so freely; nor affords the least vestage of any, when committed to distillation.

The effects of Must and Wine are diametrically opposite: Must relaxes and liquifies the animal juices, and heats the constitution; and if drank immoderately, produces dangerous fluxes. Perfect wine, on the contrary, corroborates and constringes; and if drank moderately, is the highest cordial in nature, and is the best preservative that can be, moderately taken, by those exposed to a moist corrupt air; it promotes appetite, digestion, and insensible perspiration; but if immoderately drank for a continuance, is the very reverse, lessening the appetite, and debilitating the constitution, &c.

If this fermented liquor, together with the lees, be put into a cask, bigger than will contain it, and the bung-hole closed so that the air may but just have admission, and the cask placed in a warm situation, a second fermentation will ensue; the tartar will, by the heat and motion, be resolved, and the liquor decomposed. In this decomposition the vinous spirit will be gradually destroyed or converted by the tartar to an acid, combined with a portion of the oil and the lymph or phlegm of the liquor: also an oleaginous matter of a particular kind, will subside and concrete to the sides and bottom of the vessel, of a consistence between that of unctuous and gelatinous. This is called the acetous fermentation, and the acid liquor produced, Vinegar.

'Tis pretty remarkable, that this conversion of wine to vinegar, is not brought about without a considerable degree of heat being generated during the fermentation; whereas Must, while it is fermenting in the time of vintage, scarcely grows sensibly warm; and malt liquor,

notwithstanding

notwithstanding the violence of the motion excited during the fermentation, scarcely above ninety degrees. *

We have now sketched a short view of fermentation, in which it is observable, that the grape in its progress to maturation, or growth, is first, austere or stiptic; next, sour or acid; and lastly, when ripe, sweet. So we have likewise seen, that this sweet expressed juice or Must, by fermentation or elementary combination, is converted to a pleasant pungent, spirituous wine, more or less austere or stiptic, according to the method of treatment. And by further combination, to a sharp acid.

In the making of white wine, the rape or foot stalks, and the mark or husks, of the grape, are strained from the Must previous to the fermentation: but in making red wine, the Must, mark, and all, are committed to fermentation. This circumstance contributes to their roughness and astringency; as their undergoing a complete fermentation contributes to their pungency. The judgment will be much assisted by the Appendix on foregin Wines, Brandies, and Vinegars.

FERMENTATION.

Wine and other liquors susceptible of the spiritous or vinous fermentation, contain chiefly a sweet, essential, saponaceous, oil, *i. e.* a sweet oil rendered miscible with water by means of a native acid. So the liquor producible by the spiritous fermentation, though inflammable, is still miscible with water, and consequently, composed of a watery inflammable principle. We may easily perceive, that the work of Nature chiefly consists in attenuating, dividing, and volatilising the oily parts of fermentable matters, and of combining internately with the watery principle

* Dr. Franklin's experiments on distiller's wash just fit for the still, proves the heat to be so considerable in this stage, as to amount to ninety degrees.

principle. Water consists of fifteen parts of hydrogen and eighty parts in the hundred of oxygen.

But by what mechanism does Nature approach this change? In what does attenuation of the oily part precisely consist? In what proportion is this oily, or only its inflammable principle, united with the watery principle in the composition of ardent spirit? Are the mysteries of Nature as yet unrevealed, or undiscovered to us: * we know only, that this spirit is a new being, produced by the kind of fermentation, called the *vinous* or *spiritous*.

Which is produced in the saccharine fluid in a shorter or longer time, according to the nature of the liquor, and the temperature of the surrounding atmosphere; it then swells, and is so rarified, as to overflow the containing vessel, if nearly full; an intestine motion is excited among its parts, accompanied with a small hissing noise and evident ebulition; bubbles rise to the surface, and, at the same time, the skins, or lightest particles, are buoyed up by a disengaged air, extricated by the intestine motion, and continually ascending to the surface of the fermenting fluid, and then agitated in the form of a scum, or frothy crust, that covers the face of the whole liquor, which, during the fermenting, is frequently raised and broken by the disengaged air forcing a passage through it; the crust subsiding, after each effort of the included air to escape, resumes an entire appearance.

These efforts continue while the fermentation is brisk or vigorous, and at last gradually ceases; then the crust, being no longer supported, falls in pieces to the bottom of the liquor.

The great Mr. Boyle defines fermentation to be, "A slow motion of the intestine particles of a mixed body, arising usually from the operation

* Further than we have attempted to explain them in the Doctrine of Fermentation in the two preceding Books.

operation of some active acid matter, which rarifies, exalts, and subtilizes, the soft and sulphureous particles; as when leaven, or yeast, rarifies, lightens, and ferments, bread or wort."

The yeast of beer is bitter, principally from the hop; the yeast of wort, where there is no hops, as the wort of distillers and vinegar-makers, is much less so; and the yeast does not appear to the taste, to be manifestly acid, yet it is found to contain much acid, which acid, as the yeast grows old, gradually overcomes the bitter, and at length totally covers it.

Solutions of molasses and infusions of *malt*, or watery solutions of its sweet matter, have less propensity to fermentation than the sweet juices of grapes, raisins, or fruits, and require always the assistance of yeast, or some other actual *ferment*. The quality of this ferment greatly influences that of the liquor; it seems in some measure to assimilate, as it were, the whole mass of liquor to its own nature, *or to that of the liquor from which it was taken*. How different are the products obtained from infusions of the same malt, molasses, &c. by using yeast of beer, and the yeast, or lees, of generous wine, for a ferment! How small a portion of putrid yeast is sufficient to spread putrefaction through immense quantities of wort!

I cannot resist repeating, that weak wines are improved by an addition of spirit, particularly before the fermentation is completed, for after this period it is apt to spoil the vinosity. Poor wines are enriched by sweets, and flavoured by various additions, so as to imitate the most costly; even the most delicious wines are imitable, and have been actually imitated without a drop of the juice of any kind of grape.

GENERAL RULES FOR RAISING WINES.

Take from four to seven pounds of raisins to each gallon of liquor, (that is, water) beer measure, that you employ in the quantity of wine intended to be prepared; allowing for waste of every kind you may reasonably expect the produce, in wine measure, of the intended wine, when the *steeping, pressing, fermenting,* &c. is completed.

After steeping and pressing, add to the expressed juice, from one to four pounds of *Muscovado* or *clayed sugar,* according as you intend the produce for *red* ro *white wine.*

The skins or pressings of the raisins are to be added to the expressed juice, and fermented, if you propose to make red, or even a high-coloured white wine. If red wine is the intention, *the following ingredients* are to be added in the early part of the fermenting process, if they are red, or of a reddish colour, as the longer they are in during the fermentation, the deeper the colour extracted, and of course the more roused and animated the hue. Before the *cleansing,* or drawing off the wine from the working vat or tun, (if convenient) they should be taken out, pressed dry, and the expressed juice added, or returned into the vat, in order to the more completely finishing the fermentation together. When the expressed juice is returned, so should the finer sort of flavouring ingredients, and all such as might be dissipated during the length of the process should be added; the further flavouring, colouring, and dulcifying ingredients, shall be particularly noted in the preparation of each wine, and the proper mode of conducting the fermentation, with due exactness; and the most advantageous method of using the *thermometer* and *hydrometer.* The ferment made use of, the making up, racking, fining, and bottling, shall be respectively attended to.

In the preparation of wines from sugar, honey, molasses, and other sweets, much the same rules should be observed, except the pressing, for which there cannot be any occasion, as they are soluble in the same fluid which makes the basis of the former wine.

Take from four to seven pounds of Muscovado or clayed sugar to each gallon of liquor, beer measure; to which add from one to four pounds of the raisings of the foreign wine you intend to imitate, and the colour of the wine to be produced, red, white, or high-coloured.

Though the raisings may not be procurable, the *tartar,* or *lees,* of most wines are, the former being always an article of commerce, and the latter frequently; still the lees may be procured from the wine-coopers of our own country; for you must avoid *barm,* or *yeast,* they assuredly communicating a flavour foreign to that you are in quest of.

In both these, the former and subsequent wines, either lees or tartar, or both occasionally, will be wanting as ferments, and require to be completely dissolved, before they are made use of, in part of the liquor which is to form the basis of the intended wine. See *Ferments* and *Flavouring* in this Book, and *Precipitants* in Book the First.

In the Second Book of this Treatise, under the Fermentation of Molasses Spirits and Vinegar, may be found the quantity used, and the application of those ferments in the three stages of the process, therefore they may be but cursorily mentioned here. Usually one-half of the intended ferment is added at *setting,* or commencing the fermentation; one-quarter at *rising*; this is done about, or near, the middle of the process in some cases, more frequently somewhat earlier: the *rising* is the addition of the last part of the liquor, reserved to be added when the whole quantity is not used at first, which it more frequently is not; when it is, part of the *materials,* or fermentable

fermentable matter, is reserved to be added then. See the Process of making Rum in the West Indies. *Cutting* is the third or last stage of the fermentive process, when the remaining quarter of the *ferment* is added; and near the conclusion, for cutting down the flowery yeasty-looking head, exciting a more vigourous fermentation, and expediting its conclusion; it usually increases the intestine motion of the fermenting fluid, precipitates, or cuts down, the flowery head, giving it a tendency to depurate and become fine, soon after the cessation of the hissing noise that accompanies the intestine motion. See the *Doctrine of Fermentation* in each of the preceding Books.

The particular operations enumerated under the Preparation of Raisin Wine, should be carefully adverted to in this, and the subsequent Production of Wine from *Molasses*, &c. which is so much alike, that the enumeration of them here would be tautology, and deemed superfluous in a general description, the addition of raisins, lees, tartar, &c. being the same.

All the *three* preceding processes may be safely conducted from what has been said, and what may be collected from the parts referred to, and seen in the following tables for regulating the process of preparing a vinous fluid, capable of being applied to the production of *wine, vinegar,* and *spirits,* according as it may turn out most suitable to the intention or interest of the operator. The intelligent *wine-maker* may discover the application of them to his purpose; how to select that part from the other parts, and from the tables, that he is not immediately engaged in, by what is above advanced on *setting* or *mixing, rising* and *cutting:* which are the stages in the progress of the process of fermentation, he may gather from the mere inspection of the tables.

TABLE, No. 1.

Methodically arranging the Preparation of Wine and Vinegar from Raw Materials, progressively through each Stage of its Manufacture, until finally finished for Sale in a few Weeks.

Days of the Week.		
F.	6th *Jan.*	—*Mixing*, or commencing business.
S.	7th,	—Settling.
Su.	8th,	—Settling.
M.	9th,	—*Clearing* and *setting* to ferment.
Tu.	10th,	—
W.	11th,	—*Raising* the fermenting vats or backs.
Th.	12th,	—
F.	13th,	—Mixing. *Cutting* down the frothy head of the fermenting backs.
S.	14th,	—Settling.
Su.	15th,	—Settling.
M.	16th,	—Cleansing. Setting. Sowering, or filling the casks in the stove chamber.
Tu.	17th,	—
W.	18th,	—Raising.
Th.	19th,	—
F.	20th,	—Mixing. Cutting.
S.	21st,	—Settling.
Su.	22nd,	—Settling. Cooling, or letting the fire out in the stove or sowering chamber.
M.	23rd,	—Clearing. Setting. Sowering. Depurating, over the stove chamber, and attemperating to the temperature of the atmosphere.
Tu.	24th,	—

W. 25th,

Days of the Week.

W. 25th, *Jan.*—Raising.
Th. 26th, —
F. 27th, —Mixing. Cutting.
S. 28th, —Settling. Fining, that is, putting the depurated liquor into the fining vats.
Su. 29th, —Settling. Fining. Cooling.
M. 30th, —Clearing. Settling. Sowering. Depurating and attemperating.
T. 31st, —*Racking* and *raping*, that is, putting the fine liquor over the rape.
W. 1st *Feb.* —*Raising*.
Th. 2nd, —
F. 3rd, —Mixing. Cutting.
S. 4th, —Settling. Fining.
Su. 5th, —Settling. Cooling. Fining.
M. 6th, —Clearing. Settling. Sowering. Depurating and attemperating.
Tu. 7th, —Racking and raping,
W. 8th, —Raising.
Th. 9th, —
F. 10th, —Mixing. Cutting.
S. 11th, —Settling. Fining.
Su. 12th, —Settling. Cooling. Fining.
M. 13th, —Clearing. Setting. Sowering. Depurating, and attemperating.
Tu. 14th, —Racking and Raping. Storing the finished Vinegar
W. 15th, —Raising. Cleansing the fining vats.
Th. 16th, —Pressing the dregs of the fining vats.
F. 17th, —Mixing. Cutting. *Filtering the dreg vinegar, i. e.* adding it to the vinegar on the rape.
S. 18th, —Settling. Fining.
Su. 19th, —Settling. Cooling. Fining.
M. 20th, —Clearing. Setting. Sowering. Depurating and attemperating.

Tu. 21st,

Days of the Week.

Tu. 21st *Feb.*—Racking and raping. Storing.
W. 22nd, —Raising. Cleansing.
Th. 23rd, —Pressing.
F. 24th, —Mixing. Cutting. Dreg raping.

In this manner the business may be conducted successionally for any length of time; of which this table gives a comprehensive view, regulating the method of work, with the order of time, so as to preserve order, and prevent confusion in its progress.

TABLE, No. 4.

Relative to the Preparation of Wine, Vinegar, and Spirits.

M. 6th *March.*—First setting.
Tu. 7th, —Second setting.
W. 8th, —First Raising. Third setting.
Th. 9th, —Second Raising. Fourth Setting.
F. 10th, —First Cutting. Third Raising. Fifth Setting.
S. 11th, —Second Cutting. Fourth Raising. Sixth Setting.
Su. 12th, —Third Cutting. Fifth
M. 13th, —First Singling. Fourth Cutting. Fifth Raising. Sixth Raising. First Reset.
Tu. 14th, —Second Singling. First and Second Doubling. Second Reset.
W. 15th, —Third Singling. Fifth Cutting. Sixth Cutting. First Reset. Third Reset.
Th. 16th, —Fourth Singling. Third and Fourth Doubling. Second Revise. Fifth Reset.

F. 17th,

Days of the Week.		
F.	17th, *March.*	—Fifth Singling. First Recut. Third Rerise. Fifth Reset.
S.	18th,	—Sixth Singling. Fifth and sixth Doubling. Second Recut. Fourth Rerise. sixth Reset.
Su.	19th,	—Third Recut.
M.	20th,	—First Backs Resingled. Fourth Recut. Fifth Rerise. Sixth Rerise.
Tu.	21st,	—Second Backs Resingled. First and Second Redoubled.
W.	22nd,	—Third Backs Resingled. Fifth Recut. Sixth Recut.
Th.	23rd.	—Fourth Backs Resingled. Fifth Recut. Sixtl Recut.
F.	24th,	—Fifth Backs Resingled.
S.	25th,	—Sixth Resingled. Fifth and Sixth Redoubled.

Thus they are continued, or go on for any course of time, progressively in regular succession. This table gives a comprehensive view of the method of work, and the order and regularity preserved in a well-regulated plan; shewing how busily or fully each day, Sunday excepted, is employed; and all that multiplicity of business preserved from the least confusion or jumble with each other, ascertaining the weekly produce on any sized scale.

UTENSILS AND GENERAL HEADS.

For steeping, mixing, fermenting, cleansing, and settling vats, see the mash-tuns, gyle-tuns, and cleansing-vats, of the brewer and vinegar-maker; with the mixing and settling vats of the latter; with the

the fermenting-backs, impregnators, and attemperators of the malt-distiller, in their respective plates, or engravings; the particular description of each, which will throw a great light upon the subject, and open a door to the improvement of the made wine utensils.

For an accurate knowledge in the preparation and management of each wine, look into the *Appendix on Foreign Wines,* under Culture, Gathering, Pressing, Fermenting, Racking, Fining, Making up, Bottling, &c. In which likewise may be found the mode of ordering each wine for exportation in the *wood,* and when previously *bottled;* the management of them when imported into these kingdoms. The flavouring, matching, scenting, forcing, fining, racking, parting, making up, cellarage, bottling, &c. To what they owe their fullness, thinness, flatness, sweetness, acidity, acerbity, roughness, briskness, sparkling, mantling, &c. How to recover them from the fret; restore when feint or flat; to cure when pricked or ropy; to clarify when foul, scudy, cloudy, or defaced by a flying lee; brownness and other discolourations, with the use and abuse of finings. With such helps, the practicability of advantageously *imitating* most, if not all, of the wines *imported* into the *united kingdoms,* scarcely distinguishable from the *foreign,* and when well manufactured, almost equally as good and wholesome.

At the same time amply shewing the genuine method of *imitating* the best *brandies* and *vinegars* in *Europe,* from knowing exactly the nature and qualities of the wines from which they are respectively prepared.

The most simple, and yet the most material division the wine-maker can possibly make in the wine process, is to divide them into two kinds, as a vinous fluid for the basis of full, mellow, rich, wines; and a vinous fluid for the basis of thin wines; by simple commixture, flavouring, colouring, and scenting, of which, he may be able to compound

pound most of the others, if he has a good taste or accurate palate, and can undeviatingly pursue the instructions laid down for their government, or at least their assistance.

A VINOUS FLUID FOR THE BASIS OF FULL-BODIED WINES.

In the generalizing the preparation of wine from raisins, sugar, molasses, and other sweets, I have observed a scale from four to seven pounds per gallon, under each of these articles, which admits of considerable variation of strength. The necessary additions to be respectively made to compose the varieties that are to branch out of these two leading divisions, might be made to produce a much greater number than may be wanting in most undertakings of this kind.

Raisins, molasses, and honey, produce a fluid of more tenacity and fullness than can be extracted from *grain* and other vegetables, even with the assistance of a heat under boiling. Without evaporation requiring a boiling heat, fluids, too thin for full wines, cannot be inspissated to the desired tenacity or fullness wanted, and even then would be materially injured by the heat applied; consequently it is only molasses, honey, and sugar, that can be advantageously employed in the preparation of full-bodied wines. In many cases raisins and honey are too dear; molasses and sugar, though much cheaper, are not so generally applicable; yet excellent wines may be compounded from them and a variety of our own fruits at a moderate rate; and when they turn out well, not only equal to those producible from raisins, but even to the juice of the vine expressed from the grapes themselves. Even some of the thinner sweet wines can be made up full-bodied by syrups and certain ingredients, mentioned under the wines that require such treatment.

TO PREPARE BENE CARLO RED WINE; STRONG SOUTHAMPTON PORT; TENT WINE, RED AND WHITE.

To every twenty-eight gallons of liquor used, beer measure, take fifty-six pounds of raisins; steep and express the juice, as before directed; then add an hundred weight of molasses; and so in proportion to the quantity of the wine intended to be made at one process. To every hundred weight of molasses used, take from four to six pounds of powdered tartar; if white wine is intended to be made, use white tartar; if red wine, use red tartar; and likewise return the pressings of the raisins into the fermenting-vat, or back. One-half of the molasses is to be used at *setting*, and the other half at *raising* the vats; one-half of the tartar must be previously dissolved in some of the liquor, and the whole *pitched*, or set to ferment at sixty-five degrees of Farenheit's thermometer; the other half of the molasses, and a quarter of the tartar, previously dissolved, is to be added at the raising of the vats, which is to be done four or five days after setting, by little and little at a time, completing the raising in the course of a few hours. At both setting and raising, and also during the whole operation, the vats should be kept closed, in the manner the malt-distillers keep their fermenting backs. At the *cutting*, or last application of the *ferment*, the remainder of the tartar, or lees, are to be added, according to whichever is used. See the Plate of the Distillers' Back-room, and the Description of their Backs.

As some sorts of molasses are much thicker, and therefore more pondrous than others, the quantity employed should be adjusted by weight, and not regulated by measure, which might make a sensible difference when large quantities are used at one operation; in consequence of which it might form too viscid and clammy a mixture. In proportion as the fluid mass approximates to this state, it will be the more difficult to excite a fermentation sufficiently vigourous to perfectly

fectly decompose the whole of the fermentable matter. Should this be the case, more liquor ought to be immediately added, and well roused up with the fermenting fluid; and in future more liquor and less materials employed. This rousing is necessary at each stage of the processs and addition made during the fermentation; for, if the fermentation is at any time languid, or the weather cold, agitation promotes solution, fluidity, and a more equal commixture of the materials, with an increase of the intestine motion.

By a vigourous fermentation is not meant a too violent one, which should be particularly avoided in warm weather, as it would dissipate part of the spirits, and render the produce vapid in proportion to their escape.

It is a mistake, of a very prejudicial nature, to suppose there is an absolute necessity for a free admission of external air; the express contrary is the truth, and very great advantages will arise in preventing the influx of it into the fermenting vat.

During the operation, the progress of the *attenuation* may be discovered by the assistance of the thermometer and hydrometer, let down in a tin jar, or double cylinder, into the fermenting fluid, until it descends about half-way into it, the larger containing the latter, and the smaller the former instrument; the former denoting the increasing heat or temperature, and the latter the decreasing gravity of the fermenting mass. See this more fully explained in the preceding books, under the Doctrine of Fermentation, and the Explanation and Description of the Instruments.

When the hissing noise of the fermented fluid ceases, the intumiscence also ceases, and the head or crust, if any, usually subsides, the vinous scent and flavour commonly increases, the fluid gradually cools and drops fine in a few days, sooner or later; then the new

 wine

wine may be racked from its first lees into pipes or other casks, and moved to a cooler cellar or place, where there will be a second deposition of lees; or suffered to attemperate in the same place, which will be facilitated by *cleansing*, or drawing it off from the fermenting vat into other vessels immediately.

In much the same manner raisins, sugar, honey, &c. may be treated, when intended for the basis of different wines; raisins improves the vinosity of molasses, sugar, honey, &c. When they are the basis of the intended wine, sugar, honey, or molasses, are or should be added to such vinous fluids as are prepared for the basis of full-bodied wines.

For instance, take of raisins four hundred suttle pounds, or four hundred weight; clayed sugar, fifty-six pounds; and liquor, twenty-eight gallons, beer measure; and so in proportion to every twenty-eight gallons of liquor employed: and proceed as directed in the preceding process. This, though a lighter-bodied basis for full-bodied wines, will, in common use, be applicable to those of a much superior quality, and to a greater number of wines than the former, whether *red* or *white*, and more susceptible of the impressions the operator may intend, consequently convertable to a greater variety of more valuable wines, from the more delicate vinosity of its basis. Both these vinous fluids are too *rich* and *strong* to require the addition of spirit in the making up, except for exportation, and then but a very small quantity, and only when exported in the wood. Of this more hereafter.

This vinous basis may be employed to compose Malaga wine, Teneriffe malmsey, rich Frontiniac, &c.; and if attenuated to dryness, the best Teneriffe, a tolerable Madeira, a very good Sherry, &c.

PREPARATION

PREPARATION OF A VINOUS FLUID FOR THE BASIS OF THIN OR LIGHT-BODIED WINES.

Take three pounds of raisins and two pounds of clayed sugar, to every gallon of liquor, beer measure, employed; to each hundred of sugar made use of, four pounds of tartar, finely powdered, nearly of the quality of the tartar of the country whose wines you intend to imitate; the raisins, if conveniently procurable, should come from the same quarter; if not, procure a considerable quantity of the lees of those wines from abroad, or from our wine-coopers at home, and the empty casks they were imported in, to rack them from their first lees.

This may be used to form the basis of a vinous fluid for small Madeira, St. Lucar, or thin Sherry wine, Lisbon wine, Vidonia, Oratavia, and Teneriffe wines; and if not attenuated to too great a degree of dryness, to make up with flavouring syrups, &c. for Malaga, small Frontiniac, &c.

PREPARATION OF A VINOUS FLUID FOR THE BASIS OF STILL LIGHTER WINES,

As good Frontiniac, Bucellus, Calcavella, small Sherry, small Teneriffe, and small Malaga wines; with sundry other small, delicate, mellow, wines; and if attenuated to a suitable dryness, a tolerable Champaign, white and red Burgundy, and an inferior Hock, dry Mountain, Malaga wine, &c.

Here flavouring and scenting ingredients, both of a *sweet* and *dry* class, may be employed to great advantage in the fermentation of these wines.

Take

Take of the best clayed sugar, and good raisins, each two pounds to every gallon of liquor, beer measure; employ for a ferment Rhenish argol, finely pulverized and perfectly dissolved; conduct the fermentation with great care, and let the fermenting fluid be well attenuated. Carefully make up each wine so as to avoid over-dosing them with the making up flavouring ingredients and spirits employed.

Some scents and flavours are best fixed in the syrups, particularly those residing in essential oils, as they may be formed into an *olæ-sacchrum* with part of the syrup, which will render them miscible with the wine. Some are best obtainable by distillation with spirit; others are had in the greatest perfection distilled with water; many by simple infusion, either in the making up spirit, or in the wine itself. Where it is practicable, the most convenient and least expensive way is by adding those ingredients towards the decline of the fermentation, as mentioned in the preceding pages.

TENERIFFE WINE.

Oratavia is the part where this wine is shipped from, or from whence it is sent round in small vessels to be shipped at *Santa Cruze*, the principal port in the Island of *Teneriffe*. Its proper name is *Vidonia*; it is produced from much the same grapes as Madeira wine, from which it differs more in the culture and gathering than in the pressing and fermenting. The thinner or smaller sorts were formerly made up with the *brandy* distilled from its own *lees*, and the best wines with Spanish brandy; now the inferior sorts are made up with Spanish brandy, and the better sorts with French brandy; their own being sent to the *Havanah*, a principal port in the Spanish West Indies. They render it much drier than it otherwise would be by the addition of a small portion of *gypsum*, that has been gently calcined.

For

For further information, see this wine in the *Appendix* on Foreign Wines.

VIDONIA, OR TENERIFFE WINE.

Soon as the vinous fluid you propose converting to this wine has done fermenting, and before it is racked off from the fermenting vat, draw off the number of pipes intended to be made up for Teneriffe wine, leaving each of them an ullage, wanting from four to six gallons to fill them up; all of these pipes should be Teneriffe pipes, recently emptied, if obtainable; if not, rince each pipe with a gallon of the fluid part of fresh well-flavoured sound Teneriffe lees; when even the lees are not to be had, add to each pipe a gallon of the best Spanish brandy, the third day after the vinous fluid has been drawn from the fermenting vat, in which has been infused half an ounce of almond cake.

As soon as the vinous fluid is drawn into the pipe, or pipes, add four ounces of the finest pulverized plaster of Paris to each, by little and little at a time, and mix it well up with the paddle-staff; lay a clean piece of coarse old linen over the bung-hole of each, and on the third day add to each of the above a gallon of the almond infusion; blend it well together with the paddle; bung it up and roll the cask several times over and over for a few minutes, and fill up with old wine; then set it bung up, with the bung loosly in, for a night, and so long as it appears to ferment; when that is over bung it close up; before it is moved again, rack it into a Teneriffe pipe, recently emptied, if it can be had; place a spill in it, for occasionally trying it; if not sufficiently flavoured by the almond-cake and brandy, infuse a quarter, or half, an ounce, or more, of the almond-cake in a quart of brandy, and add it to each pipe. If you miss the *Teneriffe flavour*, this treatment will secure the *Sherry flavour*. If too acid for Sherry wine, add

add two ounces of the beforementioned plaster of Paris powder; the next day half a gallon, or more, of brandy, and rack it as directed for Teneriffe wine. If not sufficiently acid for Teneriffe wine, bring it to the acidity of well-flavoured genuine Teneriffe, with *acid of tartar*. See the method of obtaining this acid, under the Flavouring of Brandy, Book the Second.

ST. LUCAR AND SHERRY WINE.

Sherry requires the vinous fluid from which it is prepared to be equally as *dry*, as for Teneriffe wine, and much less acid: indeed the predominant flavour of Sherry is compounded of dryness with the almond relish. Maderia, Sherry and Vidonia, though similar with respect to dryness in the mouth, and binding as it were on the fauces and stomach, or on all those nerves that communicate between the palate and stomach, which, together with those of the nose, form smell and taste; are dissimilar in the distinguishing flavour known to the best judges of wines. Madeira by *walnut*, Teneriffe by a *nutty*, or *sweet almond* flavour; and Sherry by a small smack or taste of the *bitter almond*, compounded with a dry binding relish, that leaves a sensation or promptitude for more.

When the energy of the fermenting vinous fluid begins to decline, so as to denote an approaching cessation of the intestine motion, add as much brandy as may be thought sufficient, in which the almond-cake has been lightly infused, divided into three or four portions, with a whole, or at least half, a day between each addition; rousing and tasting on each admixture, using the utmost care not to over-dose the flavour, or otherwise you may be obliged to dilute the flavour by the addition of more of the vinous fluid, and make much more of this sort of wine than was intended.

The

The standard I have here given for *taste,* with the help of a moderately good palate, and good samples for comparison, much exceeds any advantage that could be made of stated rules by quantity, and leaves the operator an opportunity of improving by the exercise of his judgment.

For the benefit of the diffident, I will mention as a rule never to be deviated from, to consult the culture, gathering, pressing, fermenting, racking, forcing, making up, fining, and bottling, of the wines of the country intended to be imitated, as laid down in the *Appendix on Foreign Wines.* Tartar, nitre, and hops, in very moderate quantities, give the genuine Moselle flavour.

A MEDIUM VINOUS FLUID FOR THE BASIS OF RED AND HIGH COLOURED WINES.

It is very rarely that any of the wines brought to market for *Claret* can be well imitated by a preparation designed for a general basis, from its great delicacy and dissimilarity to most other wines. Indeed, a tolerable semblance is not to be expected from the most direct process for that purpose, with the materials procurable in these kingdoms. The juice of elder-berries in various stages of their progress from acerb to full ripe, blended with the juice of red currants, borders upon it, and with good raisins, and the lees and tartar of claret, may be made to resemble it pretty nearly, when well fermented, and made up with foreign *Bene Carlo Wine.*

A few pounds of barberries, about ten or a dozen to a pipe, from their grateful acid and moderately astringent taste, will give, or at least very much assist, a well-fermented vinous fluid, prepared from raisins and clayed sugar, a fine claret flavour, which the juice of red

currants will much assist. When spoiled by an over-dose of the flavouring ingredients, the German or English arcacia, with the leaves of the barberry-tree, or bush, which bears the above barberries, and is cultivated in our gardens, and grows wild on the chalky hills in several parts of England, will each, or all of them, convert the wine intended for claret to Southampton port wine, which, by giving it time, will ultimately prove a better substitute than many that are puffed off as genuine port wine; with the advantage of being prepared from very wholesome materials. Beet-root gives the desired colour to claret.

TO PRECIPITATE THE COLOUR, &c. FROM MOLASSES.

It requiring age, or a length of time, to get rid of the disagreeable flavour attached to treacle, or molasses, both of which are particularly injurious to made wines, vinegars, &c. of a delicate taste and superior quality; after going through a course of experiments to correct, or, if possible, to remove it, I found that jelly of starch, made somewhat thinner, and more transparent than the laundresses usually prepare their starch for stiffening linen, &c. effectually discharged the colour of treacle or molasses, if previously diluted with three or four times its weight of liquor, (*i. e.* water) in the proportion of a pound of starch, made into a jelly, for ten gallons of molasses and water. This mode of refining the molasses fluid reduces it to a fine, almost flavourless, thin syrup; and when well managed, renders it as fit for our purpose as clayed sugar can be, when employed in the wine-making business. See this clarification more fully stated in the Preparation of Vinegar from Molasses.

N. B. Each of the vinous fluids, previously enumerated here, are much stronger than I employed five and twenty years ago for making

made wines, or sweets, vinegar, and brandy, * all of which much exceeded my most sanguine wishes at the time; although the materials were then two-thirds, or one-half, cheaper than at present, as may be seen by the following estimates. In the annexed tables I did not think proper to alter them.

Succeeding so much better than I expected with the following much thinner vinous fluids than those I have here recommended, induced me not to alter them in a subsequent plan which I afterwards attempted for the use and benefit of a family since settled in *America*, where they have had unrivalled success, and amassed a large fortune; who have occasionally given me to understand that they continued the mode of work projected for them, with undeviating exactness. Their summers in America being much warmer, I recommended to them, by correspondence, to use vinous fluids of the body I have previously recommended here, which has enabled them to make stronger and better keeping wines, in addition to those they first made, which are now prepared for present use only.

This they more readily came into, not only from their unlimited confidence in my knowledge of the subject, which they had fully experienced before they left England, but from the much greater cheapness of the materials with them, and the interest their success had given them in implicitly following my system. The advantages of which they improved by a commercial intercourse with the West India Islands for raw sugar, molasses, and rum, in exchange for their wines and American produce. Under the auspices of my further instructions, they then commenced distillers, and also vinegar-makers, which quadrates with the following estimates.

In 1786, to induce me to go over and settle in America, they offered me ten thousand pounds, to be laid out with thirty thousand pounds

 of

* See page 61, Book the Second, some hints on fermenting, &c.

of their own, for the making wines, vinegars and spirits, with liberty to withdraw my capital in ten years and retire, with whatever fortune I might accumulate,—which my engagements at home would not permit: though from my own knowledge of the country I wished it very much. I am now establishing a vinegar manufactory at *Philadelphia*, by correspondence, which for the present goes on swimmingly.

Four or five years previous to the time I am speaking of, molasses sold in the *West Indies* from six-pence to nine-pence a gallon, of twelve pounds weight; in 1786 it rose to nine-pence and a shilling the gallon; rum from eighteen-pence to two shillings a gallon, in exchange for lumber and provisions. In the *French* and *Spanish* Islands, in exchange as above, molasses from four-pence to six-pence the gallon, and rum from nine-pence to a shilling the gallon.

Provisions then sold in *America* as follows, biscuit from six shillings to seven shillings and six-pence per hundred weight; wheat, weighing sixty pounds per bushel, from two shillings and three-pence to three-shillings and six-pence the bushel; flour from three shillings and nine-pence to five shillings and three-pence the hundred weight; and so in proportion by the cask; salt beef per barrel from twenty-eight to thirty-five shillings the barrel; salt pork from thirty to thirty-eight shillings per tierce. The reader, from these premises, may draw his own conclusions respecting the lucrativeness of this trafic, and the subsequent advantages arising from the manufacture of molasses into wines, vinegar, and brandy. *See the Doctrine of Fermentation scientifically reduced to Practice, from page 25 to page 36, Book the Second.*

The following estimates are the result of my practice in these kingdoms, and in Holland, at the price the materials were then bought at, and that the goods or produce were then sold for here. A duplicate of

of which was transmitted to America, and also to a considerable house in *Germany*, and an eminent one in *Flanders*, and by them since carried into *Languedock*, in *France*.

Sugar, honey, and particularly molasses, will bear to be fermented in a heat of eighty degrees : this facilitates the progress of fermentation, enables the operator to expedite the attenuation, and improves the produce. The wines made in this temperature, or a somewhat higher degree of heat, keep well even in warm latitudes, and do not come to perfection too soon, provided they are *cleansed*, or racked from their first lees, soon as they drop fine ; this is assisted by suffering the place they are fermented in to gradually cool to temperate, (*i. e.* fifty-five degrees) a degree of warmth they will bear for one, two, or three, years ; but the older they grow, and the sooner they come forward, or ripen, they should be changed to cooler and cooler cellarage, and racked at every such change, always taking care to keep the casks filled up with the same wine.

Here take notice, that the hotter wine is kept, after it has approached to some degree of amelioration, or perfection, the rougher and harder it will get. The racking recommended is best performed with the *bellows*, and its proper aparatus described in the Appendix on foreign Wines : the wine being exposed to no other air, than what is introduced through the bellows, to compress it from the full into the empty cask.

The wines fermented, and properly attenuated in a warm atmosphere, and of a sufficient body, meliorate by heat, in warm latitudes, and in artificial heat, like Madeira, Sherry, and rich Teneriffe wine : it should be observed that this has its limits, and should not be carried to too great an extent. However it is more applicable to wines prepared from molasses and tartar than to any other made wines ;

particularly

particularly when yesso is added in the early part of the fermentation, as before recommended.

Let the vintagers of the wine countries, and their imitators, the *sweet makers* of these northern latitudes, never loose sight of this observation ; that there are three things necessary to the production of the *vinous fermentation, saccharine matter, tartar, and mucilage.* Saccharine matter alone containing, as is generally found in the juices of ripe grapes and many other ripe friuts, in honey, sugar, molasses, and many edible plants, these three principles, will generally run into spontaneous fermentation, when sufficiently warm, and fluid enough for the purpose. There are also three things necessary to produce the *acetous fermentation* in vinous and spirituous liquors. The existence of *mucilage;* a degree of *heat* from sixty-five to eighty-five degrees, and in cases of expedition, from eighty-five to one hundred and fifteen degree of Farenheit's thermometer; the presence of *oxygen gas,* or the free admission of atmospheric air. So great a heat as one hundred and fifteen degrees can only be obtained by the help of a stove. *See Vinegar.*

The mucilaginous principle is more especially the substance on which the acid fermentation depends; and when it has been destroyed, as in old generous wines, they are no longer capable of alteration; wines, deprived of their mucilage, ferment no more. During the length of time requisite for the completion of so perfect an attenuation, there is a gradual, and at length a total, deposition of the *tartar.* Wines deprived of their *tartar* ferment no more. This is evinced in the best of the Rhenish wines, as *old hock.* From the addition of *yesso,* Madeira, Sherry, and Teneriffe wines, evince the same. Here a great part of the native acid of their tartar is neutralized, and, forming an indissoluble saline substance with the yesso, precipitates; and in its descent carries down much of the gross mucilage, with which the Must of these wines abounds, and disposes great part

part of the remaining gross mucilage to be taken down, by the frequent racking these wines undergo.

Rhenish wines, however piquant and tart, are the produce of the most delicious sweet grapes, and owe their *dryness* and inimitable pungency to a complete attenuation, which resolves a considerable portion of the most subtile part of their tartar, and combines it into a spirituous vinosity peculiar to these wines; throwing off the more earthy parts, with the gross mucilage, to the sides of the cask in the form of tartar, which is called argol in commerce.

That elegant, light, thin, agreeable, wholesome, wine, *Claret*, is the produce of a small round very sweet black grape,. fully attenuated; by which there is a resolution of the most pure and subtile part of the tartar, as in Rhenish wines, with a precipitation of the gross mucilage. The *wine maker*, by being made acquainted with the minutia of the *cause and effect* of the excellencies in foreign wines, has information of the most instructive kind laid before him, with a view that he should profit to the utmost in a business wherein the public interest is so materially concerned. A subject never undertaken before upon so broad a basis, so methodical, or improving a plan: a subject where there is so great a dearth of information, that there is little to be gleaned up that can bear any investigation, and scarcely any traces of information. This has obliged me to resort to first principles, and take nature, and her vinous products, for my guide, making use of *foreign wines,* as the *clue* that was to carry me through this traceless labyrinth.

I do not presume to say, that there has not been made wines, nor imitations of foreign wines, hundreds of years back; for instance, *cyder* was originally called *apple wine,* and has been written on above an hundred years ago. By *Pliny* our orchards, much more extensive in his time, were called vineyards. Every good housewife

in

in days of yore made their cowslip, gooseberry, currant, raspberry, and elder, wines; mulberry, blackberry, cherry, quince, peach, and apricot, wines; in short, the production of these *home-made wines* have been the business of housewifery time immemorial; to which, in their emulation to excel, research has been made after variety, and, in imitation of African, American, and West Indian products, wine has been made from the sap of some of our own trees, as the birch, sycamore, beech, &c. When these wines are attempted both raisins and sugar will improve them much, in the proportion of two pounds of raisins and one pound of sugar, or *vice versa.*

The sap of these trees have been always boiled; this no doubt prevents that tendency to the acetous fermentation to which they are prone, but injures their vinosity, as the Italians and their Spanish neighbours do their small wines, called on that account *vino cotto.* *See Appendix on Foreign Wines.*

ORANGE WINE.

The consumption of which is considerable by the makers of *shrub,* and is sufficient inducement to the preparers of wine to make it an article of their manufacture, so as to keep a convenient stock. It is made to considerable advantage as follows:

Orange Wine of a very superior kind may be made with two pounds of clayed sugar and one pound of Malaga raisins to each gallon of water used; to which add the juice and peel of an orange; and to every hundred gallons four pounds of Rhenish tartar.

Two pounds of honey and one pound of Malaga raisins, with a large orange, juice and rind, to every gallon of water employed, and four pounds of Rhenish tartar to each hundred gallons, will make an excellent

excellent orange wine, still superior to the former. Treated according to the rules laid down, steeping, and pressing the fruit and expending the tartar, in setting, rising, and cutting the backs; the orange peel and juice are not to be added until the last stage of the fermentation, that is, on cutting the backs. The first of these wines will be sufficiently good for the *shrub makers*. They will possess infinitely more vinosity than the ordinary orange wines, indeed nearly as much as the juice of the vine.

LEMON WINE,

Equally delicious, may be made in a similar manner, to some palates more excellent. Both these wines at a considerable age lose much of the grosser part of the orange and lemon flavour; the one approaches towards the burgamot, and the other to a fine citron flavor, and become more fragrant as they advance in years. There is no dissimilarity whatever in the process. These wines may be made with the depurated or refined molasses, divested of its colour and burnt flavour, in the way before described, or from any vinous basis before recommended, giving them age in proportion to their richness.

There is not a domestic wine to which any family is habituated, that may not be more effectually made by the addition of the fruit commonly used by the good housewife, but can be made much neater, more palatable, and of a better quality, with the lighter *vinous basis*, recommended to the attention of the profess swcets or wine-makers, sufficiently saturated with the flavour of the fruits, berries, leaves, or flowers, that give a name to the respective wine. The dexterity of the manufacturer, the quantity he makes them in, with the advantage of having the materials cheaper, gives him a decided superiority over the domestic maker.

VINO TINTO.

A luscious full-bodied wine, of so deep a red as to border on blackness before it is diluted, although a wine become obsolete, not only here, but nearly so in Portugal, would prove so very useful to the makers, and makers-up of wines in these kingdoms, that its use should be revived. *See Vino Tinto in the Appendix on Foreign Wines.*

Vino Tinto, as an article of manufacture and commerce. The vinous fluid previously proposed for the basis of full-bodied wines, from the rich glutinous qualities of the materials, is best suited to the production of vino tinto, which can be impregnated with any degree of colour, however concentrated, with *Campechy-wood,* known by the name of logwood; *Cam-wood,* and other colouring substances, enumerated in various parts of this Treatise; which, if well fermented, will be flavourless, and therefore incapable of altering the genuine flavour of the wine; it becomes a colouring ingredient too.

In the making up of all wines, foreign or domestic, putting those of different ages together will excite a temporary fermentation that should be discouraged; by the wine-coopers this is called a *fret*; the coopers and wine-brewers of Holland, particularly those of *Dort,* take this opportunity of adding what brandy may be wanting, as it will blend with less injury to the vinosity of the wine, and at the same time check the progress of the fret; the *Jersey* merchants and coopers follow their example; this is called *fretting-in.* A practice too beneficial to be over-looked *by so close an observer as I have been of* THE MANAGEMENT OF WINES *in different countries:* as it does not injure the delicacy of the wines. This is a great acquisition. The wine-merchants and wine-makers may find their account in well considering its advantages. In Dort, the merchants and coopers carry this *fretting-in* to an extent; which I propose adverting to in the *Appendix,* &c.

INSTRUMENTS.

INSTRUMENTS.

The use of the *Thermometer,* and the *Hydrometer,* by some called the *Saccharometer,* may be seen under Fermentation in the First Book, and under the same head in the Second Book, and also in the Appendix on Wines. The application of these indispensible instruments is peculiarly so in the preparation of *made wines,* to which they will prove an infallible guide in the doctrine of fermentation or attenuation. Wishing to save the reader as much trouble as I conveniently can, I will lay down the following sketch.

The *raisins,* while soaking in the *steeping-vats,* will daily be increasing the specific gravity of the liquor, *i. e.* the water, they are steeping in; this will be much sooner perceptible by the hydrometer than to the nicest palate; and the increase of the gravity distinguishable every day, particularly after they begin to make a sensible hissing noise, first discoverable to the ear when placed close to the curb, or margin, of the steeping-vat, and sometimes very distinguishable at three or four yards distance.

When they are taken out of the steeping-vat, and the juice expressed, as before directed in the *General Rules,* and returned into the vat with the flavouring and fermenting ingredients, the progress of the attenuation may be exactly known by letting down the double assay-jar, as directed in page 27 of this book. This should be repeated every twelve hours for the three or four first days, during which it may be found to increase in gravity from the resolution of the saccharum and mucilage of the fruit, and probably the heat may be likewise augmented.

When the gravity seems to be stationary, or rather decreasing, the fermenting fluid will begin to send forth a vinous odour, and give a

 vinous

vinous tartness to the taste; then the heat will be more sensible, the fermentation more vigorous, and the gravity of the fluid rapidly decrease; which should now be assayed or examined every six hours. Then a more conspicuous change of flavour and smell, from sweet to tartness, or tartness to vinosity takes place, which continues until the heat decreases, the noise ceases, and the fermentation ends.

The qualities of these wines, not alluded to under each head, may be gathered in part from the *character* of the wines imitated, and the *quality* of the materials made use of. Many of them will arrive at perfection as nearly as a *copy* can approach the *original,* and some of them superior to indifferently good foreign wines, and all of them preferable to those bordering upon bad. The better these wines are brought to market, and particularly the fuller fermented, the more they will advance the quality of foreign wines towards perfection, as they will beat not only the bad, but the inferior, out of the market. Their support is more nutritious, and their effects more lasting on the human system, than the foreign wines.

The soul of their excellence exists in their being fully attenuated, kept to a due age in the wood, and their not being drank under six, nine, twelve, or eighteen months after bottling. Their sparkling or mantling in the glass will depend on circumstances similar to the foreign wines; as will their colour, brightness, or brilliancy; their flatness, fullness, sharpness, and their roughness; astringency, acerbity, briskness, and spirituosity; all of which are delineated in the *Appendix on Foreign Wines*; where stum, steeming, stooming, matching, scenting, &c. may be found, and also under Cyder and Perry.

These strong nutricious wines, when too much so, may be diluted with Spa, Seltzer, or other carbonated waters, or even with clear, simple, soft water; they seem much more agreeable to our constitutions

tions than very weak wines; these, by their spirituousness, conduce to the digestion of the gross food of our country, especially the great quantities of animal food that we consume.

The thinner wines, though more grateful to the stomach, and less disordering the head, yet they carry a proneness into the blood, which promotes a tendency to a gouty habit in the system, which deposit a chalkiness in the mucilaginous glands of the joints, when drank too constantly, or too freely, which occasion those well-known racking pains of the gout, that by degrees take away the use of the limbs.

The general effect of wines on the human body, are to cheer the spirits, warm the habit, promote perspiration, and quicken the circulation. The effects of the full-bodied wines are much more durable than those of the thinner; all sweet wines, as Canary, Malaga, &c. abound with a glutinous nutritious substance; whilst the others are not nutrimental, or only accidentally so, by strengthening the organs employed in digestion.

Sweet wines in general do not pass off freely by urine, and heat the constitution more than an equal quantity of any other. Most of the red wines have an astringent property, by which they strengthen the tone of the stomach and intestines, and thus prove serviceable for restraining immoderate secretions. Those of an acid nature pass freely by *urine*, and gently loosen the belly.

MEAD AND METHEGLIN.

An ancient vinous liquor of great celebrity in the northern parts of Europe; honey, from which it is made, being the produce of every part of Europe. Russia, Sweden, Denmark, Norway, and the most northern parts of Germany, are blest with the labours of the industrious

industrious *bee;* in the southern parts they are abundant, but these countries abounding with the juice of the vine, their application to a *vinous liquor* is generally neglected.

There are none of the natural sweets that require the assistance of *tartar* so much as honey, nor is there any of them so much improved by it; had its application to the making of *mead and metheglin* been introduced before, they would have maintained their ground much better against the juice of the vine; and it is not improbable that the introduction of it now may raise them into more general estimation than they have been for many years;—at all times a pure wholesome nutritious liquor, that never has been sufficiently fermented, nor had time given it to deterge and ameliorate itself by age, like other vinous liquors. *Pliny* records, and *Virgil* celebrates, the drinks made with honey and other fruits in commixture, particularly raspberries, and white currants, which added *flavour* and *colour*. The Romans mixed metheglin with them, and sometimes eager wines: they were generally red wines of a pure quality that they made up with it, which they so much improved, as to be taken notice of by Virgil. The wine makers of these kingdoms will find their account in keeping a good stock of it as *making-up wine*. *Foreign honey is cheap*, and in all the southern parts of Europe excellent.

The leaves of rosemary, lavender, and sweetbriar; the thin rind or peelings of oranges and lemons; and cinnamon, cloves and nutmegs, are useful and salubrious additions, greatly assisting the flavour and quality of the *metheglin*. These additions to be managed to advantage, should be frugally added about the decline of the fermentation, that is, in the last stage, by me called the *cutting*, with the last portion of tartar.

MEAD AND METHEGLIN, THE PROCESS.

To every pipe of metheglin you intend to make, take one hundred and an half of honey; if *white wine* is intended, add one hundred weight of white currants, and six pounds of *Bologna argol.* If *red wine* is intended, use the same quantity of raspberries or red currants, and the proportion of Bologna argol. With the aromatics, spices, and peels, use your own discretion in the quantity, but do not over dose your wine. The aromatics and peels are not to be added until the cask is bunged down, and then are to be suspended in gauze or muslin in the middle of the wine, to which they may be sunk by putting a piece of polished marble into the gauze or muslin along with them. Keep it from six to twelve months in the wood before you attempt to use it, and from nine months to two years before it is bottled, and your metheglin will be excellent.

Foriegn honey is generally of a thinner consistence than ours, from their using heat in the expressing it from the honey combs, and some times from the heat of the climate. We consider it to be good, when thick, and of a whitish, and agreeable smell and very pleasant taste; both the colour and flavour differ according to the plants from which the bees collect it: that of Narbonne, in France, where rosemary abounds, has a manifest flavour of the plant. Honey as a medicine is a very useful detergent and aperient, powerfully dissolving viscid juices, and promoting the expectoration of tough phlegm. Metheglin possesses a great share of these virtues, in addition to its being nutritious, and good for those troubled with the gravel, and stones in the gall-bladder, is gently diuretic, perspirative, and very corroborant.

VINEGAR.

VINEGAR.

It has been recently explained, that there are three things necessary to the production of the *vinous* fermentation; saccharine matter, tartar, and mucilage. Many sorts of saccharine matter alone contain all these requisites, as most sweets, particularly sugar, honey, molasses, and the juice of grapes and other ripe fruits, and some edible plants, as parsnips, carrots, turnips, &c. In *grain* the saccharine matter is developed by malting of the *raw-corn,* or by subsequent fermentation.

The most abundant part of grain is the amilious or starchy part, which, from its mucilaginous qualities, is more prone to the *acetous* than the *vinous* fermentation, yet less prone to ferment than the other two parts, the saccharum and the gluten. The tendency of the former is to vinosity; of the latter to putrescence.

There are also three things necessary to produce the *acetous* fermentation in vinous liquors; the existence of mucilage, a degree of heat between sixty-five and eighty-five degrees of Farenheit's thermometer, and the presence of oxygen gas, or the free admission of atmospheric air, which is composed of azotic and oxygen gas. Where artificial heat is used to accelerate the acidifying process, a *stove* is usually employed, in which, the heat is raised from ninty-five to one hundred and fifteen degrees of the same thermometer.

THE ORDER OF PROCEEDING IN THE BREWING-OFFICE, STOVE, FIELD, &c.

The brewing utensils are much the same as those already described for the common brewer, as coppers, mash-tuns, under-backs, coolers, attem-

peratots,

perators, impregnators, gyle-tuns, cleansing-vats, store-vats, mash-tuns, &c. That part of the utensils more immediately belonging to the vinegar makers are air-tight *Stoves*, a *field* or place to sour the vinous fluid, or *malt-wine*, brewed for the purpose; wine pipes fitted up with a great number of iron-hoops to enable them to bear the heat of the stove, or the vicissitudes of the weather in the *field*, for containing the malt-wine; large vats for rapes, fabric store-vats, and prime store-vats; filters; lever presses for the *dregs*, pumps, jiggers, casks, &c.

We have seen that mucilage is the basis of the acetous process of fermentation, and must here remark, that it is the parent of fixed air, or carbonic acid gas; and also, in the first and second book of this treatise, the important part this elastic fluid acts in both the vinous and acetous process; and how totally neglected its application to these important purposes has hitherto been. We shall presently see, that mucilage and sulphuric acid (i. e. oil of vitriol) are extemporaneously convertible to good vinegar, that not a particle of the sulphuric acid remains undecomposed, but is wholly converted to the acetous acid, as may be proved by the most rigorous trials, to be enumerated hereafter for the information of the reader. The ignorance in general of the operators in fermenting processes, of this one simple but leading principle, that it is the property of saline bodies to divide and attenuate mucilage, and that fixed air posseses that salinity, has been a barrier to an infinity of improvements in fermentation. Yet the good old women, who formerly monopolized the art of brewing in private familes, had arrived within a shade of the discovery, by finding out, that *beating-in the yeasty head* made their ale stronger, and caused it to become fine and fit for drinking sooner; and some of our homely common brewers also discovered, that the same practice brought their beer or ale *forward*, and caused it to *drop fine* sooner.

The fixed air generated and *evolved* in the vinous process, is imbibed or *involved* during the acetous process of fermentation, to the augmentation of its strength or acidity. Hence the transferring this elastic fluid rising from the vinous fluid into the acctous fluid and combining or fixing it there, might be *so managed* as to save from one-third, to one-half of the *materials* used in the preparation of vinegar.

VINEGAR IN THE STOVE, &c.

The best way of heating the stove, I conceive, supposing it to be of an oblong form, is by placing a cast-iron tube of considerable thickness over the fire employed for that purpose; at one end of the stove, and near to the fire-place, erect the chimney that is to carry off the smoke; cause this iron tube to continue as a flue for that purpose, nearly in a horizontal line to the opposite end of the stove, and to return back again, at about a yard distant from the under flue, with the smoke into the chimney, which will in so long a circuit have deposited the greater part of the heat in the stove, and on the acidifying fluid placed in a row of pipes on each side, on which are surmounted another row of pipes, called riders. These pipes are to have one-sixth of their content left empty to expose a large surface of the fluid to the warm atmospheric air for their acidification. Over the upper flues, and on each side over the under rows, at a convenient distance, may be placed another row of pipes, filled in the same manner. To prevent *fire* and other accidents, these should be supported on wrought iron bars, and the lower on stone, or cemented brick stillions.

Over the same fire should be placed another cast-iron tube for admitting the air of the atmosphere, which, from the tightness of the stove, has no crevices to come in at and cool the souring fluid, or let out the *acetic and azotic gases*, arising from the decomposing vinous fluid,

fluid, or malt wine, and the decomposition of the atmospheric air, which we shall shortly find use for. The tube for passing the air from without the building to the metallic tube over the fire for heating it in its passage into the stove, may be made of tin plated iron, or lead, for the better standing the changes of the weather, and the action of the atmosphere, and be provided with a valve so contrived, as to admit the air from without, and prevent the airs, or gasses, within, passing out.

The flame and smoke of the fire being the vehicle of the heat, which it deposits in its circuit through the stove, at the same time the metallic air-tube draws in heats, and distributes a constant supply of atmospheric air for acidulating the souring fluid, which being heated by the same fire may be always preserved of the same temperature.

Any necessary degree of temperature may be procured and preserved with uniformity, by these means, and by opening or shutting one or more of the air cocks, hereafter to be described, with much more exactness, than by merely raising and lowering the fire, and opening and shutting the door, as at present, by which the volatile principle of the souring fluid escapes, and is totally lost, that may now be advantageously saved, and usefully applied, as will presently appear. If the flue going in from the fire is placed under or over the flue returning to the chimney, the air flue, or tube, for the convenience of being equally heated, should pass between them throughout their circuit.

The valve, or cock, of the air tube that admits the cold air of the atmosphere into the heated tube communicating with, and heated by the stove fire, may be closed, during the exhausting the stove, or extraction of its azotic gas, &c. and when that is done, admitted for some time after for the benefit of impregnating with warm atmospheric

 air,

air, in any way it may be wanted. The air tube should have another air tube passing from it through the wall of the stove, connected to it by a stop-cock, occasionally to supply the field pipes.

For the successfully performing this to the greatest advantage, the stove-chamber should have valves, or cocks, placed in the side and end walls, most convenient to the field, or yard, in which the vinegar pipes are exposed to the air of the atmosphere.

The following Letter, which I think may throw some Light upon the Subject, I beg Leave to introduce here.

London, 15*th March,* 1782.

Dear Sir,

I received your favour of the 7th of December last, and should have done myself the honour of replying in due course, but that I waited to come at and transmit to you the information you required about making vinegar from grain; the delay proceeded from my being much engaged in business in London almost ever since; and the journals of the different processes pursued (in the way of trade) by the different makers here, being dispersed in two or three place-books, put it out of my power sooner to give you the circumstantial account that (I knew) would alone please a man of your scientific knowledge.

At R—'s vinegar work in the Borough, they brew at once thirty quarters of malt, from which they draw generally about ninety barrels of wort.

At

At P—'s, Whitechapel, they wet ten quarters of malt, and draw but sixteen barrels, from it.* At Messrs. B— and Co.'s, Lambeth, they wet thirty to thirty-five quarters of malt, from which they draw from eighty-two to ninety barrels of wort.

They consider brown malt, provided it is of the best quality and spends rich and well, the best, as the highest coloured vinegars are most esteemed in common use here. In Holland they brew their vinegars from the best pale malt and a very small portion of rye, and though their vinegars appear stronger than the English, and are really so, they draw their wort a much greater length, but part of the third and fourth mash they ferment by itself, and sell as small-beer. A practice that was in use with some whisky distillers before I left Ireland. In some of the works here, they have a practice of boiling part of the third and fourth mash for the same purpose.

The season they brew in is March, April, and on to July and August, that their gyle wine may get into the field during the spring and summer months, when they work with the natural heat of the atmosphere only, which is the general practice. P— employs a stove, or (as they call it) artificial heat; therefore brews the quantity affixed to his name (as above) every working day in the year; but though he draws his wort much the strongest, yet his vinegar, though good when new, does not keep so well.

The secret, among a few of them, is the adding a little tartar, (the majority, some spirits of vitriol) which they do privately before they cleanse off the gyle wine, (that is, the fermented wort); this is mystically done by the head man, yard man, or conductor of the work; which they think preserves it in the field, and promotes the acetous fermentation. And I believe they may be right.

Casks

* At present it is usual to draw thirty barrels.

Casks never before employed in the field, are always rinced with good sweet grounds, or bottoms, which is the true secret of accelerating the acetous fermentation. These are the most circumstantial particulars, and indeed may be truly said to be the secrets of the *whole trade*, when joined to what follows.

The cooled worts of the different *mashes*, are let down into the single tuns, and fermented; from thence pumped up to a reservoir, and conducted or let down from thence through a hose to the pipes in the field, which are left bung open, to give access to the heat of the sun and a free admission of the air; covered only by a hollow tile from February to October, and from October to February are bunged close down to keep out the cold and frost. Thus they are managed here from six to nine, twelve and fifteen months, according as is found necessary; from thence the liquor is returned in like manner to the large casks, called the fabric stores, to distinguish them from the finished vinegar casks, called the private stores; from the fabric stores they are conducted to the rape casks, which hold from one thousand five hundred to two thousand gallons, and are worked two and two together; that is, alternately pumped from one rape to the other. From the rape the finished vinegar is conducted to the private stores, where it remains until sold. As these particulars were collected with much pains, trouble, time, and expence, some few years back, with a view to engage in a work of this nature myself, when opportunity offered, an idea that I shall never desert, therefore must insist on being some ways engaged in or profited by any work of this kind you either are or may be hereafter engaged in.

Your's, &c.

R. S.

Patt. M'Bride, Esq. Dublin,
Member of the Dublin Society of Arts.

REMARKS

REMARKS ON BREWING VINEGAR IN CASTLE STREET, IN THE BOROUGH.

Thirty quarters of malt brewed to ninety* barrels of wort; the wort, when duly fermented, is pumped up to a reservoir, sufficiently high to command the yard or field, and led off by a hose to the wine pipes in the field; where it remains exposed to the sun (having no other defence from the weather than a tyle over the bung-hole) from six to nine, twelve, and fifteen months, until there is room in the (fabricating) store-cask; from these large fabric store-casks, they are cleansed off fine, and pumped over the rape, in the large rape-casks; having stood sufficiently long on the rape, it is cleansed off into prime vinegar store-casks. The chief conductor of the work adds a certain quantity of solution of tartar, previous to its coming from the working-tun; and if omitted, then previous to its leaving the jack-vat. This is a peculiar secret, and is dissolved privately for this purpose. The rape is the pressed raisins of the sweets of wine-makers, had from them for this purpose. The bottoms of the field pipes and the fabric store casks, are put together into old sweet oil casks, the bung-hole covered with a tyle, and again exposed in the field; the bottoms or dregs of these are very gross, and are put into canvas bags, and pressed in the lever press, and packed up in casks for the use of the hatters, as lees of wine prepared in the same manner.

The workmen say, that the older the rape the better; this rape is washed in baskets with liquor (that is water) once a year, or

* They begin to brew in March and end in August, consequently brew ninety barrels, for one hundred and fifty-six days, in all thirteen thousand five hundred barrels during the season.

or oftener, and again returned to the rape casks, they being also first cleaned. The casks employed in the field are old port-pipes, or old mountain-butts, hooped with from twelve to twenty iron-hoops each; the casks at first using are rinced with good sweet bottoms, or lees of vinegar, previous to their being filled with the gyle wine. The fine part of the bottoms, or lees, proves to be the strongest vinegar.

Between every two rape casks, stands a wooden cistern, and pump; near the bottom (that is between the true and false bottom) is placed a large cock; a man placed on a stage that commands the casks, stands by the pump, having first turned the cock of the full casks, pumps it over the empty rape cask, and back again at proper intervals, until the vinegar is duly completed by *receiving flavour, and growing fine.*

The worts are let down from the coolers into the copper, into which hangs a pendulous staff, loose with chains, from which staff projects a horizontal staff over the side of the copper and parallel to the top, with which a man moves the whole in a circular direction, and by that means prevents the worts burning to the bottom. These are the blue worts, or third running, only for small beer.

The worts are let down into the working vats, which are square gyle tuns, rising about six feet above ground, and open at one side about four feet above the surface of the ground, with double doors to shut the barm, or yeast, in, that would otherwise work over.

From these working tuns the gyle is let down into the jack back, (that is, the great reservoir under ground) and from thence pumped up to the cleansing reservoir, (that is, a deep cooler, or back, high enough to command every part of the works) from this it descends by its own gravity, and is led by a hose to the field, &c. &c. The field contains upwards of three thousand pipes.

From

From this field it is drawn fine into a coffin, (the coffin is a large deep trough, placed on the pipes) about the length of two pipes, that two men standing on each side of the row, (which is always two casks deep, or broad) may conveniently lift it along the row, as they draw off the fine; near either end of this is screwed a hose, that conveys it to the jack-back to be distributed over the house in the fabricating-cask, there to remain and settle until there is an opportunity of putting it over the rape.

They begin to brew in March, and continue to July or August only; this stocks their field, so as to have the whole benefit of the Spring, Summer, and Autumnal heats, to ripen their vinegar. From October to February their casks in the field are bunged close down to keep out the cold.

N. B. They wash the coolers and vats with white-wash.

METHOD OF BREWING VINEGAR AT Mr. P.'s, WHITE-CHAPEL, BY STOVE HEAT ONLY.

Here they brew every working day in the year, winter and summer, ten quarters of malt; from which they draw sixteen barrels of wort. * This wort, pumped from the under-back into the coolers, is let down into the working tun; from this it is let down into the ship (that is the jack-back under ground) from whence it is pumped into the sky cooler, and conveyed by the hose into the stoves.

N. B. From thirty to forty-eight barrels are now drawn from this quantity of malt.

* Consequently they brew about five thousand and eight barrels per annum.

The stove chambers (here) are three; two on the ground floor, one of which contains one hundred and ten pipes, the other fifty; in the loft that covers these two there is a third, of one hundred and fifty pipes.

In each of the lower chambers is a stove of cast-iron, proportioned to the size of each; from these ascend two metal flues through the floor of the upper chamber, and there enter a brick chimney; in all these chambers the pipes are placed in a row on either side, with riders; those near the stoves and the metal tubes mentioned, are defended from the intense heat by wooden screens, covered with lead.

In the stoves it remains but one week, the artificial heat souring more in that time than the natural heat of the field does in six months. The goods are now let off, and return by the hose to the ship, from whence it is pumped up to a loft, or ware-room, over the stoves, to which a glow of heat ascends; this loft is laid out like a field, with double rows of pipes; this room would be much hotter, but the air is permitted to circulate through it, and may perhaps be necessary for furthering the souring; here it remains until put over the rape, and so makes room for other goods to succeed them.

Having passed the rape, it is pumped into large stores until drawn off for sale.

REMARKS IN GENERAL.

This work takes up but little room compared to the others; requires but small brewing utensils, and few hands; the casks require little coopering; suffering much less from the stove heat, than from constant exposure to the sun and weather. The coals may be said to be an

an additional expence; but when compared to the other advantages, it is thought by no means an object.

The bottoms are managed much in the same manner as already described, and sell for the same money, *viz.* five shillings per barrel; the grains sell for twenty-pence per quarter.

In both works, the rape-casks are fitted up in this manner; about the middle of each rape-cask is fixed a false-bottom, bored full of holes; over this is spread some small birch, to the thickness of a foot; then the cask is filled, within twelve or eighteen inches of the top, with rape; over this is laid another layer of birch, up to the top.

N. B. The worts are not boiled for making vinegar, except those of the blue, or fourth mash, neither in this, the following, nor the former work.

The method of knowing whether Hops were employed in the making of Vinegar. Neuman, by Lewis, page 449, says, it is observable, that when malt liquors turn sour, the bitterness of the hop, though strong before, is covered or overpowered by the acidity. It is not however destroyed; on adding an alkaline salt or absorbent earth, in sufficient quantity to obtund the acid, the liquor tastes bitter again, as at first.

Ditto, 458, *The method of detecting Oil of Vitriol in Vinegar.* Drop into the vinegar a solution of chalk made in aquafortis, or spirit of salt: if the vinegar is pure, no change will ensue: if it contains any vitriolic acid, the mixture will become milky, in proportion to the quantity of that acid; the vitriolic acid uniting with the dissolved chalk, into a compound no longer dissoluble, and which, on standing, subsides in form of a selenetic powder.

Ditto, 462, *The method of finding the Strength of Vinegar.* The degree of strength of acidity of vinegar may be determined, as that of other acids, by neutralization with pure fixed alkaline salt, and exsiccating the compound; as the alkali retains only the acid part, the increase which it has now gained in its weight, will give the quantity of acid contained in the vinegar.

In the following experiments an ounce, or four hundred and eighty grains of the vinegars was employed.

Quantity of Vinegar.	*Saturated by fixed Alkali.*	*Weight of the neutral Salt.*	*Quantity of Acid.*	*Quantity of Phlegm.*	*The kind of Vinegar employed.*
Grains.	*Grains.*	*Grains.*	*Grains.*	*Grains.*	
480	16	24	8	472	Pale beer vinegar.
480	16	24	8	472	Brown beer ditto.
480	26	38	12	468	Wine ditto.
480	72	120	48	432	Spirit of Verdigris.
480	270	437	167	313	Concentrated vinegar.

Hence concentrated vinegar is seventeen times stronger than malt vinegar, and ten times stronger than wine vinegar; that is, it contains seventeen and ten times as much acid in the same measure.

Observations

Observations from Maquer's Chemical Dictionary, Letter V. The worts, or gyle-wine, should be exposed to a heat of from eighteen to twenty degrees of Mr. Reaumuir's thermometer, that is, from seventy-two to seventy-seven degrees of Farenheit's. In France, the wine is immediately put on the rape as soon as the vinous fermentation ceases, and is finished in about fifteen days, during the summer; but if the heat of the air be so very great as to exceed the twenty-fifth degree of the thermometer, the vinegar must be shifted from rape to rape every twelve hours, otherwise once in twenty-four hours will be sufficient.

N. B. When the hissing noise of the fermentation ceases, in the half-filled rape, the fermentation is over, and the vinegar is made.

Tartar. The method of finding whether vinegar has been made from tartar, or with a great portion of tartar, from Lewis's Note, page 457, Neuman's Chemistry.

The acid of tartar has been supposed by some to be similar to that of vinegar, but is found upon experiment to be notably different. It does not, like the acetous acid, render fixed alkalies soluble in spirit of wine, nor form a saccharine concrete with lead, when combined with alkaline salts or with absorbent earths, into a neutral salt; vinegar as well as the mineral acid, added to a solution of this salt, precipitates the tartar in its original form, and unites with the earth or alkali in its stead.

EXPERIMENT.

Take one ounce of suspected vinegar, neutralize it with fixed alkali; exsiccate the compound, powder it, and put it into a phial with six drachms of highly rectified spirit of wine; if it totally dissolves, it contains no tartar. But if, on the contrary, a part remains undissolved, it may be concluded to contain tartar. Or if the exsiccated compound be dissolved in eight or ten drachms of fair water, and strong wine vinegar be gently added, the tartar will gradually precipitate in its original form; and the vinegar will unite with alkali, and, on exsiccation, form a true *sal diureticus* that will dissolve in spirit of wine.

N. B. Spirit of wine added to vinegar newly made from tartar will precipitate the tartar.

The two following experiments show how to recover vinegar from a slight corruption, and also how to increase its sharpness, without the addition of any other acid.

Lewis, Neuman, page 458. Wine vinegar, when run a little beyond the acetous state, and begun to enter upon the putrefactive, is still in the power of art to recover. The putrefaction must be stopped by quenching a red-hot iron in the liquor; and the acid, which has been lost or destroyed, may in some measure be restored, by the addition of a little spirit of wine, rye-bread, mustard-seed, &c.

The putrefaction of vinegar is prevented in the same manner as the fretting or acetification of wine, by racking it off from the feculencies, and keeping it in a close-stopped vessel in a cool place.

Such

Such vinegar as has once suffered a considerable heat, cannot be long preserved from corruption.*

Pyrethrum Pellitory of Spain. The root is employed, as Neuman relates, to sharpen vinegar; I think, it should be laid with the rape, when only natural heat is used, but when artificial heat is employed it should lie in the stove casks.

METHOD OF BREWING VINEGAR AT MESSRS. ——, LAMBETH.

Their mash-tun wets from thirty to thirty-five quarters, from which they draw from eighty-two to ninety barrels.† They have three working-tuns, each of which is large enough to work one day's brewing. So that they have, during the brewing season, (from March to August) one vat working, one vat cleansing, and one scouring, cleaning, and white-washing, for the next day's gyle. This custom of white-washing, with whiting, the coolers and vats, is, from being found a necessary preservative from corruption, become the universal practice of the vinegar-makers; but established upon no good foundation.

Previous to cleansing, or drawing off the gyle wine, they privately add a certain quantity of tartar, (this is kept a secret) which, they think preserves it in the field, and promotes the acid ferment; and I believe

* This is a mistake. Scheele has shewn that vinegar, that has suffered a boiling heat in *balnea aqua*, and corked up when cool, is a preservative to it. The process of making pickles proves this.

† The medium of which is eighty-six barrels, and during the season twelve thousand nine hundred barrels.

believe they are right. They have also a curious conveyance under ground, through leaden or pewter tubes, for conveying the vinegar to the field, and re-conveying it back again to the fabric stores. This field consists of upwards of two thousand pipes. The rapes here, and with the makers in general, are considered as stores, being generally drowned with good saleable vinegar, if not used in pumping over. From the fabric stores it is pumped over the rape; from that put into old stores, (that is, the prime vinegar stores) and from thence packed up in hogsheads and half-hogsheads, as sent out. Here it may not be improper to observe, that there are small rapes at Mr. R—'s, that do not hold but from one thousand five hundred to three thousand gallons; whereas the rapes in general hold twenty thousand gallons; but of the house we are describing (Mr. B----'s) they are not less; and R---- has some that contain more. At Mr. R----'s house there is a prime store that contains upwards of forty-seven thousand five hundred gallons, beer measure; this is an oval cask, its longest diameter is thirty-nine feet, its transverse (that is, shortest diameter) is thirty-three feet.

At Mr. R----'s, their yard-man pays uncommon attention to the new vinegar, and covers it not only with a tile, but with a small piece of a stave, just sufficient to cover the bung-hole. This bit of wood, by being flat, keeps in the heat during night, and when the sun gets up, he has the bung totally uncovered, that the sun and heat may get in; and he has succeeded in his management of the field (or yard) better than the former yard-man.

Mr. B— (who seems born for the trade) is not only his own yard-man, but superintendant or inspector-general of every department, notwithstanding he has every department filled with able hands.

Order, regularity, and neatness, mark every part of the concerns; and in some respects, beauty, splendour and greatness.

All

All his vinegar pipes lie in one field, level as a bowling green; encompassed on one side with an elegant plantation of great variety, both of flowers, flowering shrubs, and almost every kind of tree. Through which meanders a well-composed serpentine gravel walk, on which are several retiring places, alcoves, and summer seats. On the other side is a large grass plat, containing two pieces of water; in one is a fountain, together with his wine and vinegar works and offices. At one end his house, at the other his orchard and kitchen garden.

The pipes are all planted in rows, forming, alternately, a wide and a narrow alley; the wide alleys consist of double rows of pipes, and are four feet asunder: the narrow alleys are those formed by the passages between these double rows, and are two feet wide. The pipes stand, bung up, on continued stillions of wood, resting on transverse brick-stands, about twenty inches high.

In this delightful factory he has united, the city house, country seat, plantation, and factory, and that in the precincts of the city; and may be truly said to have blended the useful with the agreeable.

VINEGAR IN THE STOVE AND FIELD.

When warm atmospheric air only is wanted to be drawn from the stove for the field pipes, at any time that it may not be convenient for extracting the azotic gas, the stop-cock of communication between the entering air-tube and the exit air-tube may be turned, and a hose led from the part outside of the wall into the pneumatic engine, and the nozle of the engine joined to the bent tube and air-valve in the vessel to be impregnated, and the necessary charge thrown in, as before described.

By means of two or more pneumatic engines, of no greater size than a man can work, great part, if not all, of these impregnations may be conveniently performed, without any material alteration in the present utensils, or mode of work, with astonishing simplicity and effect.

Should larger vats, and a considerable revolution take place, engines proportioned to the effect to be obtained, and more suitable to a new and important undertaking, shall be brought forward.

Warm air can be commodiously procured at any degree of heat below boiling, by means of a double copper tube; that is, one inserted within the other; the inner soldered, or screwed, on an inclosed iron boiler, containing water to be boiled by the stove-fire; the steam rising from the boiling water heats the inner tube; the outer one, as the inner one heats, draws in the atmospheric air through a register that regulates its admission, and also heats it in its passage to the vinegar pipes. To prevent it and the included air being cooled, there may be another tube inclosing both of the two former, which will prevent the heat communicated by the steam to the air in the middle tube being taken up by the atmosphere in its passage to the pipes. There ought to be a contrivance to convey the condensed steam back to the boiler, and to admit fresh water as the other boils away.

When any one or more of the pipes or casks in the stove required impregnation of any kind, that is either with the compound air of the stove, or with fixed atmospheric, or inflammable air, it can be thrown in, by working the engine without, through the nearest air cock, placed in the wall of the stove.

For impregnating the vessels in the stove with their own compound air floating therein, by means of a bellows without the stove, double cocks

cocks must be used, or an engine without, communicating with a ventilator within.

When large casks, or even vats, are substituted for pipes, and when the whole of the oxygenation or acidification is performed by art, the business of vinegar making will be reduced to a certainty and uniformity of produce, not now obtainable by the old process, with fewer hands, in less compass, and at infinitely less expence; as the vessels will then be under cover; that is, nothing will be left (as at present) exposed to the weather, the alternate changes of which are so destructive, and a suitable mode adopted of keeping the store cask always *air tight*, much will be performed, and much saved, that is not now calculated on.

This will soon be rendered very apparent, by pursuing the plan I have laid down, of accommodating these improvements to the present mode of work, and applying them to the utensils in use, with but very little alteration, and the least possible expence.

So that a stove and its contents can be worked by the engine or engines with as much facility as a common cask, and stoves impregnate stoves, as working tuns impregnate working tuns, even as they now are composed of a number of pipes, and much more so when they consist of one or two rows of large vats, round, square, or oblong.

Particularly while the working is continued in the field as well as in the stove, promiscuous contents, fixed, common, and azotic airs, and volatile acid, can be *exhausted* or extracted together, either to impregnate the casks in the stove or in the field, like a chain or receivers, connected with a retort or distilling vessel, by which one engine may impel them through a whole line of vessels, by a valve and tube in each.

 The

The best Manner of obtaining and applying Oxygen, Hydrogen, and Carbonic Gases.

This may be accelerated by the suction of another engine, placed at the other end of the line of casks, to exhaust or draw the filtered elastic fluid out, and invite its circulation through them, and propel it through another line of casks, together with a fresh source of elastic fluid derived from another vat; and connected by a hose to the second bellows or engine, and so on, to impregnate twenty or thirty casks at once, from four or five sources of supply, or as many vats or casks generating the elastic fluid.

In the same manner, the different elastic fluids can be combined by one engine, and impelled into the same cask or casks, according to the object in view.

And one man may, by moving a pendulum with a crank, work two pair of bellows, pistons, &c. at once.

In like manner the warm volatile contents of one stove may be transferred to another that is cooler, either to communicate with the whole or any part of the casks therein.

It is a well known fact, that *carbonic acid gas* does not act as an acid until combined with water, or a liquid of which water is the basis. Fixed air being of an *acid quality*, and inflammable air of an *alkaline quality*, they may be made to saturate each other, and really do so in the common operations of Nature, particularly in the vinous decompositions of matter decomposed in fermentation.

For

For instance, transfer the carbonic acid gas arising from the vinous process of fermentation, into worts, wash, or vinegar, (particularly the two former) and inflammable air, at the same time, both into the same liquid, and they shall unite therein, and form *spirit* or *vinegar* in proportion as they are more or less oxygenated.

Or impregnate the worts, or *wash*, previous to the usual addition of yeast operating on the worts, with *hydrogen gas*, in the proportion of one part to three of carbonic acid gas that they should generate; the hydrogen gas will combine with the unfermented worts, or wash, and after the commencement of the fermentation, the fixed air as generated, will also combine with the fluid previously saturated with the inflammable air into *spirit, wine*, or *vinegar*.

That this does really take place may be known from there afterwards being little or no escape of carbonic acid gas, during the vinous process of fermentation, it being absorbed by the hydrogen gas previously combined and combining with the worts, or wash; by these means the fixed air is arrested for the manifest increase of the strength of the fermenting fluid beyond any thing in the ordinary way.

And if any fixed air should be generated and escape, the impregnation of the inflammable air should be renewed and continued as long as fixed air escapes, or is generated, to preserve the equilibrium, and promote the fermentation of spirit, or vinosity, in wine, vinegar, &c. agreeable to the operator's intentions.

If hydrogen gas is transferred into fermented liquors that are grown sour, as wine, cider, beer, ale, &c.; in proportion as it is absorbed, the acidity goes off, and the impregnated fluid becomes more spirituous than it was at first. Hence, hydrogen is to be added in the vinous, and carbon in the acetous process of fermentation.

During this, a large portion of the undecomposed fermentable matter of these fluids give out, or generate, fixed air, which being absorbed as generated, combines in a nascent state with the impregnated fluid, to the obvious augmentation of pungency and spirituosity.

Fixed air is with more difficulty combined with the vegetable acid fluids, and that in proportion as the acetous process draws to a conclusion.

Yet fixed air may be advantageously employed to oxygenate acidifying fluids, as it contains three times as much oxygen as atmospheric air. Atmospheric air contains twenty-three parts of oxygen gas and seventy-two of azotic gas in one hundred; fixed air contains seventy-two parts of oxygen gas and twenty-eight of carbonic gas in the hundred. Hence, even water impregnated with fixed air may be converted to the acetous acid, by the further oxygenation of the atmosphere; particularly when any hydrogen is present in the fluid, as fermentable matter, spirit, &c. I have already defined fermentable matter to be composed of saccharine, mucilage, and animal gluten.

The *saccharine matter* of grain is resolved into spirit by the vinous process of fermentation; the *mucilage* is the subject on which the acetous process acts; and the *gluten* is decomposed by both, and ultimately by the putrid process of fermentation.

The object of *malting grain,* is to develop its saccharine matter, and to resolve or decompose its gluten. It is obvious, that if *raw corn* is fermented, the undecomposed gluten, saccharine matter, and mucilage, are blended in their primitive, or natural, state, and decomposable together in the fermenting fluid. *Malting is a species of fermentation;* hence it follows, that all these operations of fermentation may be performed at one operation. The previous malting

expedites

expedites the subsequent fermentation, but by weakening the grain, lessens both the spirituous and acetous produce; hence raw corn is the most productive.

If intended for Spirit, or Vinegar, the trouble, delay, and expence, of *malting* is saved. The *unmalted corn,* measure for measure, will undoubtedly produce more *spirit,* or more *vinegar,* than *malted corn.* Here is a saving both ways; first, in expence and duty of malting, and secondly, in the measure and quality. Be it remembered, that partially malted, or badly malted, corn is, in effect, nothing more than a mixture of malted and unmalted corn.

This has been attempted to be rendered more advantageous still, by making both spirit and vinegar from the same materials.

That is, by distilling the produce of the vinous process into spirit; and making vinegar of the *spent wash,* by the acetous process.

Thus, by acidifying the most fluid parts, and applying the grosser to the feeding of hogs or horned cattle, and giving them water for drink that has stood on the grains that form part of their food, which I have known to agree very well with them. I have also known hogs to fatten very fast on grains and water alone, given to them in this manner. Hence all the fluid parts of the wash are saved for vinegar. The fluid parts of spent wash were supposed to make the strongest vinegar; but experience evinces the contrary.

SPENT WASH VINEGAR.

The spent wash should be let down from the cock of the still into the vinegar stove settler; from whence the fluid parts should be conveyed into the fermenting or acidifying vats or pipes.

This saves time, trouble, and fuel, and by this means there could not be a sudden separation of its parts by cooling, condensation, and a subsequent precipitation, nothing subsiding in this way but the grosser parts.

The *settling room* might be under, or at one end or side of the *stove chamber*, and the *attemperating room* over it and the stove chamber, when the new-made vinegar would gradually descend to a temperature not much above that of the atmosphere, and be in a state to be oxygenated superior to that in the field. Indeed, under these circumstances, a very small field would be requisite.

RAW CORN VINEGAR.

We are led from these observations to discover, that neither the vinous process, nor cooling the worts, are absolutely necessary to the preparation of vinegar, either from *malted* or *unmalted corn*, or from mixtures of them.

Where vinegar is to be soured, either by natural or artificial heat, the previously undergoing the vinous process, must, on consideration, appear unnecessary, if not disadvantageous to the acidification, spirituosity preventing sourness in beer. Heat and air are the primary agents of acidity in fermentable fluids; the saccharine matter being comparatively small to the mucilaginous, and the latter only the

source

source of the acetous fermentation, by virtue of which, even the vinous, when completed, passes to the acetous process, for without mucilage there can be no acidity of the acetous kind.

A close observer may judiciously inquire, after you have converted the *saccharine* part of the grain into spirit by the vinous process and subsequent distillation; and the mucilaginous part by the acetous process of fermentation, to vinegar; how do you get rid of the *glutinous part?*

The answer is obvious to persons conversant with the doctrine of fermentation. Part of the *gluten* is decomposed in the vinous process; the boiling necessary to the subsequent distilling more completely unites the *mucilage* and remaining *gluten* together, and as the spirit is drawn off, they approximate to a closer union, and by the subsequent acidification are both converted into vinegar, if the acetous process is perfectly completed; when not, the gluten remaining undecomposed forms part of the dregs of the vinegar, as it now does, and like an incompressible sponge holds much acidity. With regard to the gluten exciting a putrid tendency in this, or any other vinegar, the produce of grain, we are provided with an expedient to prevent such accidents in future, *never before employed.*

When the vinegar of the upper room has come down to the temperature of the atmosphere, it is in a state proper to blend with that in the *fabric stores.* It is further oxygenated by the *rapes,* and by passing, repassing, pumping over, &c. from time to time, till fitted to blending with, or becoming a part of the *prime stores.*

Thus the trouble, delay, and expence, of malting is saved; the whole of the inflammable spirit saved; the boiling of the worts, and the vinous process of fermentation, rendered unnecessary to the

making of vinegar, and the process materially expedited; and at the same time hogs or horned-cattle may be fed and fattened with equal facility as usual; in short, this expediting the process of *vinegar making*, executed on a plan of advantage unequalled in a proportion beyond every comparison whatever, whether it is done with *malted* or *unmalted* corn, or with mixtures of them, as now practised by the *malt-distiller* for making *malt-spirits*, and feeding of hogs or horned-cattle only.

In whatever light we view it, it is surprisingly advantageous. If the vinegar-maker takes it up, he has the spirit clear; if the malt-distiller takes it up, he has the vinegar clear; the materials for the spirit costing the vinegar-maker nothing; and the materials for the vinegar costing the malt-distiller nothing; affording a variety of important benefits, of which either has their choice.

RAW CORN VINEGAR, UNCONNECTED WITH DISTILLING.

When distilling and vinegar-making are not united at one manufactory, the raw corn requires a vigorous fermentation, principally of the acetous kind, whether soured in the *stove* or in the *field*, to decompose and recompose all the principles into one mass, for the obtaining good vinegar from the whole of the grain.

Whether raw corn, malted corn, or mixtures of them, are used, a peculiar attention to the *heats* the *liquors* are taken at, the standing of the *taps*, and the *lengths* drawn, are indispensibly necessary in the brewing part; also a close attention to the degree of heat, and admission of warm air, when the goods are in the stove, are equally requisite. Heat and air being the instruments of the acetous fermentation.

The

The component oxygen of the materials, so abundantly disengaged during the vinous process, uniting to carbon and caloric, escapes from the fermenting mass under the form of fixed air, and is saved and combined under the form of oxygen, which oxygenates the fermenting fluid during the acetous process, in those goods that have not previously undergone a vigorous vinous process of fermentation. *See the Table of Vinegar Estimates.*

CIDER AND PERRY.

The Apple Wine of our fore-fathers, the outline and preparation of which still maintains its ground in *England,* though driven out of *France,* and almost out of the *Netherlands,* by its superior in all nations, the juice of the vine—*Cider,* as well as *Metheglin,* has been celebrated by the *Grecian* and *Roman* authors, although it might never have merited celebrity in any country so much as in our own, to which the *longevity of its drinkers entitle it.*

It, as well as our porter, with all their excellence, have not escaped the voice of interested detractors; added to this, the national weakness of most countries to over-look the bounteous produce of their *own,* cheaply procurable, while they ardently lust after the more costly produce of a foreign land. These are deep-rooted prejudices not easily extirpated, even by the wisdom of legislative authority, that sinks under the lighter, but reiterated attacks of irresistible *fashion,* that parti-coloured, ever-changing phantom, which bewitches the inhabitants of every country it influences.

THE UTENSILS

Are grinding-mills, pulp-vats, both lever and screw presses, underbacks or receivers, fermenting-vats, cleansing-vats, hair-cloths and hair-bags, which seldom supersede the use of wheat-straw, containing and delivering cask; in large *cider offices* mashing or stamping machines, moved by horses, which some prefer to horse-mills, consisting of a large stone, moved perpendicularly upon a horizontal stone, like the tanners' mills; hand-mills, turned by one or two men, will grind ten or fifteen bushels of apples a day, these suit those who work upon a small scale; the large more modern presses are very similar to our packers' presses, which are sometimes made even larger. *See Wine Presses.*

Gentlemen who make their own cider, can render it very delicious, when it is too full and sweet, by mixing it with the wines imported, when they are rather declining, that is, growing acerb, tart, rough or eager; when cider is too rough and tart, by mixing it with *metheglin*, or even with clarified honey; carefully adding and blending them with each other, until the desired flavour is obtained, it will be much improved.

Cider, as a vinous basis, is capable of being converted to a variety of *made wines*, by attending to the means employed by *wine-makers*, for *flavouring* and *imitating* foreign wines with the produce of this country, and also to the preparation and composition of foreign wines. *See Appendix.*

In making cider, it was formerly the custom to boil it, and sometimes to add spices to it. The object of this process was to make it stronger; and accordingly it was boiled, as soon as pressed, and kept scummed continually till its colour was considerably heightened. This custom has long been disused in Herefordshire; and is continued only

only in some parts of Devonshire, where the fruit happens to be of an inferior kind. In a late publication of the Bath agriculture society, there is an account of a method of boiling cider, to make cider-wine; in which it is mentioned, that a great quantity of cider has been boiled down into wine in the county of Somerset. From the specimens however produced before the society, and the investigation of the process, it appears to be neither a pleasant nor a wholesome liquor. It seems indeed, that cider, which by any process could be made stronger than the natural juice of the apple, would lose more, in flavour and richness, than it could possibly acquire in point of strength. The natural strength of cider of the best kinds, when properly made, and ground in horse-mills, is so considerable, that there have been instances of its keeping twenty or thirty years, or even a longer time, in the greatest perfection.

It may not be improper in this place, to give a short account of the common *Herefordshire method of making cider.* The fruit is gathered when quite ripe; which is known by its beginning to fall. The apples, when got together, are laid in the open air, in heaps of about a foot and a half or two feet deep; but not more, lest they should heat. When they begin to decay they are fit for grinding; those that are black-rotten being first thrown away. The fruit is then ground, till the rind and kernels are well bruised, which are supposed to add much to the flavour and strength of the liquor. It is not pressed as soon as ground, but is put to stand for a day, or somewhat more, in a large open vessel. It is then pressed between several layers of hair-cloths, in the press, and the liquor is received in a vat, from which it is removed into casks, which stand in any cool place, or even in the open air, with their bung-holes open. These casks are watched with great care, till the cider (in technical language) drops fine, when it is immediately racked off from the lees, into other casks in the cellar. This first racking is of the greatest consequence, as cider which is suffered to become foul again, by missing the first opportunity of

of racking it when fine, will never make a prime liquor. After what is clear has been racked off, there remains a quantity of lees, which being filtered through coarse linen bags, in the form of jelly-bags, yield a very bright and strong liquor, but extremely flat, which is added to the cider already racked, and, by its strength and flatness, contributes to prevent or check fermentation, an excess of which is sure to make cider thin and acid. The casks are therefore not filled quite full, neither are they stopped quite close; and when the cider inclines to ferment, it is again racked; which it sometimes requires two or three times. It must not however be racked, unless when it is absolutely necessary for the purpose already mentioned; as every racking is supposed to weaken it. This therefore must depend upon the practical skill of the operator, and seems to be that critical part of the management for which no adequate rules can be prescribed. When all probability of fermentation is over, the casks should be filled up with cider of the best quality, and the bung be closed in firm with rosin.

OF GATHERING AND PREPARING APPLES, &c.

After you have brought your plantation to such perfection that you can gather fruit enough of your own to make cider, or other liquors, according to the nature of the fruit; the first thing to be considered is its maturity, there being much cider spoiled in most parts of England, through that one general error of gathering fruit before its maturity. For there is scarce any fruit in the world but yields very different liquors, according to the different degrees of maturity of the same fruit. As the juice of the cocoa-nut, whilst green, is a pleasant thin drink, but when thoroughly ripe, becomes a rich oil or milk; so the juice of our European fruits, which, when most mature, yields a pleasant drink, if pressed before, yield but a crude and sour liquor.

This

This error or neglect (occasioned partly because the several sorts of apples ripen not at the same time, or that the wind prevents their hanging long enough on the trees, or the gross ignorance of the operator, or his covetousness of having more liquor than otherwise he should expect) hath not only been the occasion of much thin, raw, phlegmatic, sour, and unwholesome, cider, but hath cast a reflection on the good report that cider well made most rightly deserves.

Therefore, in case your fruit be not ripe all at one time, select such as are of a like degree of maturity, and, according to the quantity of them, proportion your vessels; for you had better make it at several times than spoil your whole vintage.

Or, if the wind should beat down many of your apples, and you are unwilling to spoil or lose them, you may let them lie dry as long as you can before you grind them, that they may obtain as great a degree of maturity as they can; and let that cider be thoroughly fermented before it be barrelled, according to the rules hereafter set down, and not kept too long, to acquire too much acidity.

Let not the practice of those who advantage themselves by mixing unripe with ripe fruit, or by grinding their apples too soon, induce you to follow their example, as it is much better to lose a part than spoil the whole.

To prevent which ill effect, let your fruit be thoroughly ripe; which is known, first, by the colour of them, if you are acquainted there-with, else that may deceive you; some apples appearing brighter before they are ripe, than others when full ripe; the same may be observed in pears; some sorts requiring twelve or fourteen days thoroughly to maturate them, after they seem to be as ripe as the ordinary Flanders fruit. Secondly, by the smell, most apples and pears casting a fragrant odour when ripe, and is a very good sign of their maturity, although some apples and pears have little smell,

and

and yet make excellent cider. Others also have a strong mellow scent, as several early summer fruit, and yet yield a sharp liquor, unless cautiously made. Thirdly, by the blackness of their kernels, which, when they are of that colour, signifies, that the fruit is inclining to be ripe; for after the kernels are black, the fruit ought to hang on the trees some time to perfect their maturity; the liquor within them being better digested and concocted by the virtue of the sun on the tree, than by any artifice whatsoever afterwards.

On the other hand, be cautious of letting fruit hang on the trees too long, lest they grow pulpy, which some summer apples and pears are apt to do; it so unites the juice with the fleshy part of the fruit, that it is difficult to separate the one from the other.

When your fruits are in a good condition as to maturity, and the weather fair, then gather them by hand; which if your stock be not greater than your number of hands, is a much better way than to beat or shake them down; but if your stock exceed, then shake them down, so that the ground be dry. For this purpose low trees are to be preferred.

If any of your fruit happen to be broken, lay them by themselves, an ordinary bruise not much injuring the fruit; but where the skin is broken, the spirits exhale, for the bruises beget a fermentation, after which the spirits first rise, being, where the skin is whole, detained.

In some parts of England, their ignorance, or rather laziness, is such, that they scarcely bestow the gathering of their fruit to keep for their tables; how then can you expect their care of cider?

Some prefer the grinding of apples immediately from the tree, as soon as they are thoroughly ripe, because they yield the greater quantity of liquor; they also pretend, though erroneously, that the cider

cider will drink the better, and last longer, than if the apples were hoarded.

But if you intend to have your cider pleasant and lasting, let them lie some time in a heap out of the sun and rain, and on a dry floor, on dry rye, wheat, or oaten straw is better, until they have either sweated out, or digested, a certain crude phlegmatic humour that is in most of our fruits; the same you may observe in nuts and all sorts of grain.* The time for this must be referred to your discretion, some prescribing a month or six weeks, others but a fortnight. Be sure not to let them lie too long, lest they grow pulpy, which will very much incommode your cider, although some are of another opinion, *in medio virtus;* from ten to twenty days are the best times; the harsher the fruit, the longer the time.

The greatest inconvenience of pulpy fruit is, that, at the first pressure, it yields less cider, and thicker than that which proceeds from fruit less pulpy; but the cider of pulpy fruit is to be preferred. The right way of managing it will be hereafter treated of.

Let them not lie on a floor of ill savour, nor on deal-boards, but with straw under them, lest they contract an ill relish, which an apple will do in a sweat; nor let them lie abroad, as some will do, except on dry ground, and in dry weather, covered. Although rain can do them no more hurt than fair water mixed with the cider, yet every sort of apple will not bear it. And the lying of fruit abroad in the rain and cold dews, makes the cider flat and dull.

For, from the due time, place, and manner of hoarding of the fruit, oftentimes the cider is very good, which otherwise might have proved very bad.

 By

* This is more properly a rarefaction of the fermentive juices, bordering upon a previous stage of fermentation, similar to malting; and is liable to be misconducted.

By hoarding only your windfalls for some time, or until the time that it was expected they should have been ripe in, doth very much meliorate the cider made of them, which otherwise might have been very bad.

Thus when your fruit is duly ripe, gathered, and preserved, it is ready for the mill.

OF GRINDING APPLES.

One great impediment in the improving of this most excellent drink, hath been the want of a convenient way of grinding or bruising the fruit. It having been the usage or custom in most places of England, where but small quantities of this liquor hath been made, for the operators to beat their fruit in a trough of wood or stone, with beaters like unto wooden pestles, with long handles. By which means three or four servants or labourers might in a day's time beat twenty or thirty bushels of apples; some part thereof into a jelly, being often under the beaters, whilst other part of the fruit, by its slipperiness, escapes the beaters, much of it also by dashing being wasted; yet by this means were made very great quantities of cider in several places.

But where the fruit increased, that this way become too tedious for the ciderist, the horse-mill was, and is, still much in use, grinding for the whole parish; that is, by placing a large circular stone on edge in a round trough, made also of stone, in which the fruit is put, and ground by the single upright stone moved round by a horse, as the tanners grind their bark; in which mill may be ground sometimes three or four hogsheads a day, and some are so large, that they grind half a hogshead at a grist.

These

These mills are very chargeable to make for any one that hath but an ordinary plantation; and to carry your fruit to a parish-mill, and bring back your cider, &c. is troublesome, if at any distance; and to the cider made therein, is imputed an unpleasant taste, acquired from the rinds, stems, and kernels of the fruit, which in these mills are much bruised.

Some have taken the pains to grate apples on a grater made of perforated latten, such as house-wives use to grate bread on; others, to beat them on a table with mauls; but these ways are to be rejected as idle and useless, where you have any considerable plenty of fruit.

To remedy the inconveniencies, trouble and expences in those several ways that have been hitherto used, you may erect a mill, the ichnography whereof, you have in the following figure.

DESCRIPTION OF A CIDER MILL, PLATE VIII. FIG. I.

Let there be two planks, *a a a a*, of about three feet in length, or more, and about sixteen inches in depth, in case your cylinder or roll be but one foot diameter, or according to the diameter of your cylinder, that there be about two inches above and below the same. If your planks will not bear the breadth desired, they may be enlarged by the addition of a piece of the same thickness, without any inconvenience. Let the planks be about two and an half, or three inches thick, and made to quadrate to each other. Let there be four mortices in each plank, as at *b b b b*, for transoms, to keep the two sides at an equal distance, about half an inch wider than the length of the cylinder, that it may have the more liberty to move without grating. The four transoms may be pinned fast into that plank that is next you when you turn, and their tenons made long at the other ends, that they may be two or three inches without the other plank,

that

that they may be keyed at the farther side, the better to take to pieces when occasion requires.

c, Is the center of the cylinder in each plank exactly one against the other; there must be a hole for the axis to run in, which ought to be strengthened with a small plate of iron or brass, to prevent wearing.

d d Shews only the circumference of the cylinder, which at *e* appears more plainly, being made of solid oak or beech, the dryer the better, and freer from shrinking, of about a foot or eighteen inches in length; and if a foot in length, then eighteen inches in diameter; if eighteen inches in length, then a foot in diameter; after which rate you may vary as you please. This roll or cylinder must be turned exactly on its axis, which must be made of iron of an inch square, and fixed through the center of the cylinder; then turning it on that axis, with a turning gouge and chisel, will cause it to run true; which is principally to be observed. The axis must extend beyond the cylinder six or seven inches at the one end, where it must be flatened an inch or two, with an eye, that the hand-wheel may be keyed on there, as at *f*.

This cylinder, after it is placed between the two planks in its frame, must be knocked full of small pegs of iron, of about three quarters of an inch in length, made flat, and tapering like a wedge, as at *g*. They must not stand or appear a full quarter of an inch above the superfices of the cylinder; for the shorter they are, the finer will your pulp or murc be, and the higher, the courser; you may place them in such order, that the one may stand against the space last preceding, in a quincunxial order; about four hundred of them will serve for a cylinder of a foot in length, and of the like diameter, and so after that rate for a greater or lesser. Thus will this cylinder be made rough to grind your apples as fine as you please; then cut a

piece

piece of wood of the length of the cylinder, and about a fourth part of its circumference, hollow almost to the circumferential line of the cylinder, as at *h;* this piece must have a pin at each side, near the upper part of it, as at *i i,* which must have holes in the two planks for them to move easy in, as at *k*; the use whereof is to keep the apples close to the rough cylinder, that they may be thoroughly ground; this is also governed by a movable transome that extends from the one plank to the other, through the mortices at *l,* which mortices are made broad, to admit of keys to force the regulator, or piece of wood, nearer or farther, as you please.

The prickt lines shew the boards that descend from the hopper or bin, to direct the apples to their work.

Note, That the greatest inconveniency that ever happened in several years experience of this mill, was, that mellow apples being pulpy and light, would stick to the cylinder, that it would much impede the operation; which is easily prevented by making the cylinder smooth, and placing the pegs of iron not too near, but leaving sufficient spaces; that when the cylinder is wet with the juice of the apples, the pulp may fall from it in its motion; which it will easily do, and the better if the pegs be not flat headed; always observing, that the distances of spaces of one row, may be filled or supplied in the next two or three rows, that the apple may not wear in ridges.

It hath been also found by experience, that the moveable piece *h,* being placed so much under the cylinder, did hinder the pulp from falling off the cylinder; therefore I have placed it higher, and took away the piece I set above it, and when the apples were mellow, laid a great quantity of fruit in the hopper, or bin, the weight of which kept the fruit close to their work; by which means this single-roll mill made not only a quick dispatch of the fruit, but ground them exceedingly well.

By

By this mill have been ground very fine, sometimes five, and sometimes eight bushels of apples in an hour, and with no harder labour, than that two ordinary labourers may, the one feeding, and grinding, hold it by interchanging, all the day, with ease and delight.

But if your stock be so great, that this small and easy mill will not dispatch them fast enough, or that you intend it for general use; then may you make your planks the longer, and place two rolls or cylinders.

To the first or nether roll, you may make, either one handle to turn it, or if you please, you may, by letting the spindle come through at both ends, have two handles, that by two men turning of it a greater dispatch may be made. This way of the double cylinder appearing to be the most natural and efficacious way hath occasioned many and various experiments towards the perfecting of it. At the first, about seven years since, I made the two rolls smooth, which would not by any means take the apple; then I made them rough by cutting small grooves, which by placing the rolls at some distance, caused the apples to pass through them, which only bruised them into big pieces; then by the wedges made for that purpose, I placed the rolls nearer, and caused the same broken apples to pass through again, at which second time they came very finely ground. But this double labour, although far exceeding any former old way, yet seemed not to be the utmost perfection of this mill, and so cause my self and several others, to whom I had imparted those experiments and observations I had made about it, to try what farther might be done, to make this curious machine more useful and facile; whereupon several at the same time discovered this very way that is now in use, which is as follows:

Let the cylinders, or rolls, be about eight or ten inches diameter, and about ten inches in length; let the teeth be about two inches, or two inches and an half distance, so that they may be capable to take
in

in an apple of an ordinary size; let both the cylinders, or rolls, be so near of a size, or rather the handle-roll the bigger, that the number of the teeth in both being equal and cut straight, they may not interfere the one with the other; let the teeth be cut bellying, or rounding, so that in the turning the rolls they may shut even in every place alike, according to *a a*, in the second figure.

By this means, whatever fruit you throw in, the teeth takes them and reduces them to a pulp, in case you set the rolls near enough, for the nearer they are, the finer will they grind, and the farther apart the coarser, but they will then make a quicker dispatch; and for mellow fruit, it is not very material that they be finely ground. You must be sure to keep the mill constantly fed by hand, and not over-charged, lest it choak and soon tire the grinder.

Some make the nether, or handle roll, less than the other, as the first about six inches diameter, and the farther about twelve inches, with double the number of teeth to the former, by which means the mill will go much easier than the other way.

In both these, the axis of the farther cylinder or roll must be movable, pieces of wood or iron being made in the inside of the planks, to be wedged nearer or farther, as occasion requires; those of wood being represented by *b b* in the second figure, and those of iron by *c*, in the same figure.

This mill will thoroughly grind fruit enough, by one man's labour in turning, to make near twenty hogsheads of cider in a day, and of a duration, (the rolls being made of lignum vitæ, and the rest, for the most part, of iron and brass) that it will last an age.

Although your habitation be far from London, yet it is better to have your mills from an experienced artist, than confide in country workmen,

workmen, who, either from ignorance or envy, make this most useful engine so as to become of little advantage to you.

This mill may be made to be worked by water, where your house stands near some current, by an under-shot wheel fixed to the axis of the cylinder, or roll, extending itself eighteen or twenty-four inches from the body of the mill. Or, in case your water be not strong enough to drive it with an under-shot wheel, a small spring raised high enough to drive an over-shot wheel, of eight or ten feet diameter, will grind a great quantity of fruit in a day, having one to serve and feed it. And less water, if but little raised, will serve where the single roll, or cylinder, is used, that going much easier than the double.

On any river may be fastened by an anchor and cable, a barge, lighter, or other vessel, overthwart which may be laid a beam, or axis, at each end whereof let there be a wheel of floats, and about the middle of the axis you may cut teeth, as in the second figure, and make another roll to answer it; in case your current be strong, you may make the teeth the longer, and the other roll answerable, and the more apples you may add at a time in the feeding of it; by means whereof the apples of a whole parish or town, or more, may be ground without any other labour than attendance. The one end of the floating vessel may serve to contain the fruit, the other vessels for the pulp, the press, &c. Such a machine placed in the river Thames, near London, would turn with every tide, and dispatch vast quantities of fruit that are usually beaten up for cider in the three months of September, October, and November, in and near the city.

As for the handles of the hand-mill or mills, it is very convenient that there be a wheel, as in the plate may be discerned; and that the handle be near two foot from the center; for the larger, and heavier

the

the sweep is, the better and more easily does it dispatch the harder or tougher fruit.

It is also convenient, that the farther end of your hand-mill be fixed against some post or wall, that it may endure sudden jerks without displacing; for its loose standing is a great impediment to a quick operation.

Also in the double roll-mill, you must be sure to have boards under the rolls, both on the sides and at the ends, to convey the pulp into the vessel placed underneath for receiving it; for otherwise the quick motion of the rolls will dissipate the pulp, which now will be entirely conveyed into the receiver, which may either be a tub or kiever, or a square chest, made long and deep, of elm well jointed, and fitted to shove in at the end under the mill, on two rolls placed on the lower part of the tressels or frame on which the mill stands, for that purpose; when this receiver is full, it is easily drawn out, and when emptied easily shoved in again.

When you bring your apples to the mill, as you fill them up, cast by all such as are green and unripe, rotten, or otherwise damaged, and all stalks, leaves, &c. that may injure the cider; for it is better to lose a small quantity of your liquor than spoil the whole.

Some are of opinion, that rottenness in the apple does not injure the cider, but that a small quantity of rotten apples mixed with the sound, is a great help to the fermentation and clarification of the cider. But, I presume, they mean such apples only that have been bruised in gathering, shaking down, or carrying, which will, by lying, become rotten, and (the skin being whole) not much the worse, only the cider will retain a smack of them; yet let me advise, that you admit not them amongst the cider that you intend for keeping, but rather make cider of them for a more early spending; for others

m affirm,

affirm, that one rotten apple corrupts a whole vessel, which, I suppose, means those only of the putrid rottenness.

It is not necessary to grind your apples very small; for if they are not very small ground, you will have but little less cider, (although the contrary is generally believed) because in the common way of grinding or beating, much of the apple escapes unbruised, unless the whole be very much beaten or ground.

After your fruit is ground, it is good to let it stand twenty-four or forty-eight hours, according as your time or conveniency will admit, so that it be all together, or in good quantities in large vessels: for standing thus, it not only undergoes one degree of fermentation or maturation, but acquires colour, much commended in cider, and also causes the lesser parts of the apple unbruised, easily to part with its juice in the press; although the general advise is, to press it in the mill.

You may leave a passage open in the bottom of your vat, wherein you keep your bruised apples, during the time of its being therein. Some of the cider may spontaneously distil into a receiver placed under it; or you may have a false bottom in the inside full of holes that the greater quantity may be had, which may run into your receiver.

Which cider so obtained far exceeds that which is forced out; as the wines of France that are unpressed, which are much preferred to those that are pressed; and live honey that distils of itself from the combs, is much better than that which remains, and is afterwards pressed out.

As for your press, there is no form yet discovered that exceeds the screw-press, some of which are large enough to press a hogshead at

one

one time; and as some report, that a hogshead or two runs out commonly before the apples suffer any considerable pressure.

In those large presses, the usual way is to press it on straw, by laying clean wheat-straw in the bottom of the press, and a heap of bruised apples upon it; and so layer after layer, by twisting the ends of each layer of straw together, until you have raised it two foot or more, as your press will give leave; the straw forms a kind of wall round the apples, and keeps them in. Then apply your board and screw over it, and you may press it dry in form of a cheese, which is the most expeditious way, and most for advantage, of any way yet known; for a small single mill, after the form before described, will grind in one day as much as a man can well press in a good screw-press in another day. Some of these large screw-presses are made of two screws, and some but of one; but in case your stock be but small, a less screw, and of much less price may serve, made after the form of that in the plate; and instead of straw, you may have a basket or crib well made, and put straw round it in the inside, to preserve the pulp, which would otherwise either run through, in case the passages be wide, or choak them in case they be narrow; or a hair bag placed in a crib or frame made under the screw, to preserve the bag from tearing.

In your pressing, in case you intend not to use your pulp afterwards for the making of water-cider, usually called *purre*, or *ciderkin*, then it is best to press it as dry as you can; but in case you resolve to add water to your marc, and to press it again, then you need not press it too hard, for your cider will then be worse, and also your purre or ciderkin; for the last squeezing is the weakest, and makes your cider rougher; and gives it a woody taste, unless it is prevented by easy grinding.

Some commend the flail-press, being made after the manner of a cheese-press, with heavy weights or stones at the end of the flail, which, near the fulciment or center, hath great force on the matter to be pressed, and as the pulp yields its juice, so this weight follows it, until it be pressed as well as by this means it can be done, and that without a constant attendance, which is required in the screw-press; the liquor, thus gradually expressed, descends more clear than that which is forced out suddenly by the screw; but this way is not the most expeditious, nor to press it dry, unless it stand long.

But if you are willing to decline the screw, you may make a press that shall press gradually, as doth the flail, and much more expeditiously, and may be made to equal the screw-press for expedition and quantity, and will make the pulp, especially of mellow fruit, yield its liquor finer than from the screw.

The way is thus: Let there be two posts fixed in the ground, as *a a*, about three feet apart; with two transoms, well tenanted into them, as at *b b*, which may be about two feet or more apart; through the middle of which may be made two mortices to let down the toothed iron-bar, or rod, *c c*; the back, or smooth side, whereof must bear against brass, or against two trundles, or rolls, of iron or brass, to make it slide up and down easily; between the transoms let there be an axis of iron, of about an inch and an half diameter, or more, having two round places filed against the two posts; let there be a nut, or toothed-wheel, in the middle of it, of about four inches diameter, and one inch in thickness, or near thereupon; there may be twelve teeth on it, or about that number, according to their size and distance; let the teeth in the upright bar, or rod, be cut so that the advantage in distance may be on the nut, because that is the mover, and the upright bar the moved; then let the axis, with its nut on it, be so placed into the two upright posts, with staples and brass at each end, that it may move at a fit distance, that by the teeth of the nut the

the upright bar may be elevated or depressed at pleasure. This inside work may be plainly discerned at *d.* The nearer the nut is placed against either of the rolls that are placed in the transoms, the less will the upright bar be apt to bend.

Let each end of the axis itself, beyond the upright-posts, be fixed into the center of wood, resembling the nave of a wheel, into which the leavers *e e e* must be fastened.

Let there be eight leavers, or more, on each centre, so placed that the leaver on the one side may be against the space in the other. There may be a ring of wood, as at *f f*, made to preserve them at their true distance, and that all may bear their proportionable burden, though the weight be but one or two. This ring may be placed at about two foot from the center.

For a farther strengthening of the leavers, in case they be made slender, or the weight too heavy for them, you may add stays of wood, or small iron, as at *g g*, and so may continue them to every leaver.

You may have in readiness by you several weights of stone, iron, or lead, with rings, cords, or other fastnesses to them, to the quantity of three or four hundred weight, or more, some of half an hundred, others less.

The lower end of the toothed bar must be fixed into a follower of wood, under which, when it is raised to its heighth, at about two foot distance must be placed a large bench, made of a thick plank, of five or six inches thick, and fixed at both ends to the upright posts, as *h h.* On which you may place your matter to be pressed.

Then

Then with your hand move your leavers, until it presseth hard or tough; then hang on a weight on the end of one of the leavers, having a hook of iron for that purpose fixed at the end, and another on the other side; and as the liquor flows from the pulp, so will that shrink, and the weights move downwards; then you may add more on the next upper leaver, and as they sink you may take them off from the under and apply them to the upper; and while these weights are doing your work, you may otherwise employ yourself until they need removing.

These leavers have very great strength, being thus placed, and may be made of equal force to any screw, for this work, and have these advantages above it; that it requires not so constant attendance as the screw; where the fruit is over-ripe or pulpy, it presses the liquor out more gradually, which with a sudden force it will not so easily part with. You may also place more under this press at a time, than under the screw, so that in size it be proportionable, because it may stand longer in the press, and be more easily managed until it be dry-pressed; and (which is a considerable advantage) the liquor will descend more fine out of the pulpy fruit, by this gradual way, than from a more violent forcing screw, pulpy fruit usually emitting a thick juice, if suddenly forced from it.

In case your leavers be but five or six feet in length, they will easily move round without being hindered by the ground; but if you make them longer, you may sink the ground on each side of the posts proportionably, more conveniently than you can raise the press.

PURIFYING CIDER.

As your vessel fills under your press, pour it through some strainer into a large vat, only to detain the gross pieces of apple, &c. from intermixing

intermixing in the vat; from whence most prescribe to tun it immediately into the barrels wherein it is to be kept, lest its spirits should evaporate; which is a mistake, for if a cloth only be cast over the vat or tun, it is sufficient to preserve it; for there is in it a wild spirit, * that, if detained, will break any vessel whatever that you shall inclose it in, therefore to waste that is no injury to your cider.

When it is in your tun or vat, it ought to be there fermented, and in some degree purified, and from thence separate the pure from the impure, and tun into the vessels wherein it is to be preserved, that the dregs may not pass with it, which will very much incommode your cider.

In order to which, it is to be understood, that the juice of the ripe pulpy apples, as pippins, renetings, &c. is of a syrupy and tenacious nature, that, whilst it is cold, detains in it dispersed those particles of the fruit, which by the pressure comes with the liquor, and is not by standing, or frequent percolations, separable from it; which particles, or flying lee, being part of the flesh or body of the apple, is (equally with the apple itself, when bruised) subject to putrefaction; by which means, by degrees, the cider becomes hard or acid; but if it be pressed from other apples, as redstreak, gennet-moyle, &c. which more easily part with their liquor, without the adhesion of so much of the pulp, and of a more thin body, this liquor will not be so subject to reiterated fermentation, nor so soon to acidity, because it wants that more corrupt part which in the other comes with it.

For wine, ale, beer, and other liquors, in every degree that they tend to acidity, become more clear by the precipitation of the more gross parts that are first subject to putrefaction, and so in time, as those corrupt particles were more or less in it, the liquor sooner or later becomes vinegar.

If,

* Fixed air.

If, therefore, you intend your cider shall retain its full strength and body, and to preserve it so for any considerable time, endeavour to abstract from it that flying lee, or *materia terrestris,* that floats in it, (as sometimes it does in Must pressed from grapes, that hath in it more of an active principle than that from apples) lest your cider be thereby impaired.

Neither is it to be imagined, that the sort of cider that is of that tenacious nature as to keep up its lee, is therefore stronger than that which more easily lets it subside, any more than that thick, small, unfermented ale, should be stronger than that which has more of the spirit or tincture of the malt, and well fermented; or that wine should be smaller than cider, for the same reason.

Now rightly to understand the cause of this detention of lee in the body of the liquor, you are to consider, that there are several sorts of fruits that yield a clear and limpid juice, as a grape, and a common English and Flanders cherry, and some others; and other sorts of fruits that yield a more gross juice, as a raspberry, black cherry, plum, and some others; and there are some fruits that yield a very thin and clear juice at a certain degree of maturity, which when more ripe, becomes thick and gross, as a gooseberry, currant, and some species of apples and pears.

In the grape, and English and Flanders cherry, the cause that the liquid part so easily parts from the solid, may be from the great inequality in the proportion of the parts, the liquid being the more, and overcoming the lesser; while in the other, cherries, raspberries, and plums, the contrary happens, that much of the pulp adheres to the liquor.

Also in the other fruits, as gooseberries, currants, and some apples and pears, by the length of time, a thorough maturation causes a solution

solution of the more gross parts, being of themselves tender, which makes them so acceptable to the palate, which in fruit more insoluble does not so happen; yet may the juice of those fruits that are extracted more pure and limpid, be more excellent, and may be preferred to those more gross, as usually happens, because of the difficulty of defecation.

One principal help to purify any liquor, or to provoke fermentation, is warmth, as is commonly practised amongst housewifes, who, in fermenting both bread and beer, preserve it warm during that operation.

It having been experienced, that wine in the Must, before it has begun to ferment, being stopped close in a vessel, and let down into a well or river, will for a long time retain its sweetness, without any sensible fermentation, by reason that the coldness of the ambient body of water (the like happens from a cold air) checks fermentation.

Therefore warmth is a principal means to accelerate fermentation, as has been sometimes tried in cider, by heating a small portion of it scalding hot, and casting it into the tun on the new Must, stirring it together, and covering it over, which has caused a good fermentation and separation of its lee, making it much more fit for preservation than if it had been barrelled without any fermentation at all. It has been also observed, that cool cellars protract the fining of cider; and that cider exposed to the sun, or other warmth, hath more easily fermented and become fine, for the reasons aforesaid.

The Germans have stoves in their vaults, which they heat very hot, or else make fires before every vat, by which means the Must of their wines ferments vehemently; after some days they rack it; the same may be observed with cider, whilst it is new, but if it has stood long and is then served thus, it must soon become acid.

But to fine and purify this British wine, or any other vinous liquor, effectually, you may take of isinglass, one or two ounces to a hogshead, beat it thin, cut it in small pieces, and lay it to steep in white wine, (which will more easily dissolve it than any other liquor, except vinegar, spirits, &c. that are not fit to be used in this work); let it lie therein all night; the next day keep it some time over a gentle fire, till you find it well dissolved; then take a part of your cider, in a proportion of about a gallon to every twenty gallons, in which boil your dissolved isinglass, and cast it into the whole mass of liquor, stirring it well about, and covering it close; let it stand to ferment for eight, ten, or twelve hours, as you please; during which time, the finings being thinly and generally dispersed through the whole mass of liquor, precipitate a part of that gross lee, that otherwise would have decayed it, and raise another more lighter part of it; as a net carries before it any gross matter in the water through which it is drawn, and leaves not any part of its own body in the purified liquor, to alter or injure the substance or taste of it. When you observe that it has done working, you may draw off at a tap under the scum, or may first gently take off the scum, as you please. Or you may use it thus: steep your isinglass in hard white wine, enough to cover it; after twenty-four hours beat the isinglass to pieces, and add more wine, and four times in a day squeeze it to a jelly; and, as it thickens, add more wine; when it is reduced to a perfect jelly, take from a pint to a quart for a hogshead, and three or four gallons of the cider you intend to fine, and mix it well with your jelly, and put it into your vessel of cider, and beat it with a staff. This cold way is much better than the other, for boiling a part of the cider makes it apt to decay the sooner.

This liquor, thus gently purified, you may in a full vessel, well closed, preserve a long time, if you please, or draw it and bottle it in a few days, there being no more lee in it than is necessary for its preservation.

The

The shavings or chips of fir, oak, or beech, are great promoters of purification, or fermentation. Therefore new vessels cause a quick fermentation; but be sure they are well scalded before you use them, least they occasion too violent a fermentation, and make your cider acid.

But if your cider has stood long, and will not be fine, as oftentimes it so happens; then take isinglass about an ounce to an hogshead, and steep it in about two quarts of cider a day or two, until the whole be reduced to a jelly, which, by standing warm, it will easily do. Then draw off about a gallon of the cider, and mix the gelly (being cold) thoroughly with it, and put the whole into the vessel of cider at the bung-hole, and with a spiit-staff stir it well together, and in a day or two it will be fine, without any prejudice to your cider.

This way is better than the tedious ways of percolation, and racking from vessel to vessel; which wastes not only the spirits, but substance of the liquor itself, and leaves you but a thin and flat drink, hardly balancing your trouble.

After you have thus purified your liquor in what vessel soever, and are unwilling, or cannot well draw it out at a tap near the bottom, as is usual, you may draw it from the feces over the brim of the vessel, by a siphon made of glass, which is the best, because you may observe by your eye what impurities ascend, and avoid them by raising or depressing your instrument at your discretion. The siphon is after this form, * the one end three or four inches longer than the other, and the calibre of the pipe according to the use you intend to put it to, whether out of a great or small vessel.

* 

To make this siphon of glass, furnish yourself with a glass pipe of what size and length you please, and make a charcoal fire in some open place; lay down your glass pipe on the charcoal, so that the fire may be near the middle of it; remember to lay the pipe on the coals before they are very hot, that the glass may heat gradually as the fire kindles. When the fire burns clear, and the glass is become red hot, then take both extremes in your hands, and bend it to what form you please, holding the bended part over the heat, that it may not cool suddenly, but by degrees, to prevent breaking. Thus may you bend any part of it to make it suit with your occasions.

Liquors thus purified leave at the bottom a great quantity of gross and impure feces; which, if from cider, you may cast on the pressed murc, to meliorate your ciderkin, or water-cider, if you intend to make any.

These impurities, which are in great plenty in pulpy fruit, and also in raspberries, currants, &c. are the principal cause of the decay of those liquors by their currupt and acid nature exciting the more vinous parts to a continual fermentation, as is evident from the discharge of fixed air, and breaking of bottles, on the change of temperature in the atmosphere.

After your liquors are thus purified and drawn off, they are to be inclosed in proper vessels for some weeks or months, according as the nature of the liquor or your occasions will permit or require. Before that be done, it will not be amiss to insert some observations concerning vessels.

VESSELS FOR KEEPING AND PRESERVING CIDER.

It has been no small occasion of the badness of this liquor, and thereby giving it an ill name, that it has been usually ill-treated, and put (after it had been indifferently well-made) into ill-shaped, corrupt, faulty, and unsound, vessels; vinous liquors being full of elastic air, that easily find vents, through which the atmospheric air corrupts the whole remaining body; and also more easily, especially the cider, like the apple, attracting any ill-savour from the vessel; therefore care ought to be taken in the choice of them.

It has been observed, that the larger the vessels are, the better liquors are preserved in them. In some foreign countries vessels are made that will contain many hogsheads of wine; which, being kept in so great a quantity, is preserved much better than if divided into smaller vessels.

Also the form of a barrel has been found to be very material; although the common round barrel is most useful for transportation from one place to another, yet is the upright vessel, whose ribs are straight, and the head about a fourth or fifth part broader than the bottom, and the height equal to the diameter of the upper part, the best form to stand in a cellar; the bung-hole, of about two inches diameter, is to be on the top, with a plug of wood turned round exactly to fit into it; near unto which must be a small vent-hole, that, after the cider is tunned up, and stopped at the bung, you may give it vent at pleasure; and that, when you draw it forth, you may thereby admit air into the vessel. This form is preferred, because, that most liquors contract a skin or cream on the top, which helps much to their preservation, and is in other forms broken by the sinking of the liquor, but in this is kept whole; which occasions the freshness of the drink to the last. *See the Plate.*

It

It is also observed, that a new vessel made of oak, tinges any liquor at the first with a brown colour, wherefore it is requisite thoroughly to season your new vessel with scalding water, wherein you may boil apple-pumice, if you please, before you put your cider in them; which, when so seasoned, are to be preferred to any that have been used, unless after Canary, Malaga, or Sherry, wines, or after metheglin, which will much advance the colour and savour of your cider; but vessels out of which strong beer or ale have been lately drawn, are to be rejected, unless thoroughly scalded and seasoned, as before, which then will serve indifferently well, nothing agreeing worse with cider than malt; for of cider, or water-cider, boiled and added to malt, has been made a liquor not at all grateful. Small-beer vessels, well scalded, are not amiss; white or Rhenish wine vessels may do well for present drinking, or for a luscious cider, else they are apt to cause too great a fermentation.

A good ciderist will have his vessels wherein he puts his pulp or ground fruits, wherein he presses and tuns his liquor, and wherein he makes his ciderkin, all of them appropriated to that use. The taverns will furnish him with large casks very proper for these uses.

For the using of these vessels, between the cider seasons, with beer and ale, not only prejudices the cider, but the using them for cider, injures very much the next brewing of ale or beer.

If your vessels be musty, boil pepper in water, after the proportion of an ounce to an hogshead; fill your vessel therewith, scalding hot, or let it stand two or three days; or, take two or three stones, or more, of quick-lime to six or seven gallons of water, which put into a hogshead, and stop it close, and tumble it up and down till the lime be thoroughly slacked; but the best cure is to take them to pieces, and pare away the film that is in the inside, and when aired set them together again.

To

To make your cask pleasant to receive so delicate a guest as your choicest cider, you may scent it as the vintners do for their wines, thus: Take of brimstone, four ounces; of burned allum, one ounce; and of aqua vitæ, two ounces; melt these together in an earthen-pan over hot coals; then dip therein a piece of new canvas, and instantly sprinkle thereon the powders of nutmegs, cloves, coriander, and anniseeds; this canvas * set on fire, and let it burn in the bung-hole, so as the fume may be received into the vessel.

Glass-bottles are preferred to stone-bottles, because the stone-bottles are apt to leak, are rough in the mouth, and they are not easily uncorked; also they are more apt to taint than the other; neither are they transparent, that you may discern whether they are foul or clean; it being otherwise with the glass bottles, whose defects are easily discerned.

First grind them rough with coarse emery, then make them smooth with fine; if the mouths of the bottles be uneven, (as they usually are) you must grind them smooth with a wooden plug in a turn, and polish them smooth, by which means the corks may be preserved.

The only objection against this way of closure, is, that not giving passage for any spirits, the liquors are apt to force the bottles, which, when stopt with cork, rarely happens, as the cork being somewhat porous, part of the spirits, though with difficulty, transpire.

If glass-bottles happen to be musty, they are easily cured by boiling them in a vessel of water, putting them in whilst the water is cold, which prevents the danger of breaking; being also cautious that you set them not down suddenly on a cold floor, but on straw, board, or such

* Which is called a vintner's match.

such like. If your glass-bottles be foul, you may cleanse them with hard sand, or small shot, rolled and tumbled up and down in them with water, which will also take away the mustiness from them.

TUNNING, BOTTLING, AND PRESERVING CIDER.

Having your cider purified and prepared in the tun, and your vessels seasoned and thoroughly dried, and fixed in their places, then tun it up into them until the cider be within an inch or less of the top of the vessel, that there may be space for skin or head to cover it. Be sure to leave the bung open, or only covered two or three days, that the cider may have liberty to finish its fermentation; but if it be so clear that it will not again ferment, and that you are willing or intend to keep it long, put in unground wheat, after the proportion of a quart to a hogshead, which will give it a head sufficient to preserve it. This artificial head is only wanted where an admission of air may probably get into the vessel.

Other artificial lees there are, that may serve for cider as well as for hungry wines. As a decoction of raisins of the sun, or the shavings of resin fir-wood; but the best addition to preserve it, is the new lees of Spanish wines.

After you have thus closed up your bung-hole, you ought to leave open the small vent-hole, only loosely putting in the peg, lest otherwise the wild spirit of the cider force a passage; as I have known it a week after its tunning to have heaved up the head of the barrel almost to a rupture, which, by the easy stopping this vent, and sometimes opening it, may be prevented, until you find it has wasted that wild spirit. For the common method of barrelling up cider from the press, and then stopping it close, is pernicious to this liquor, many having spoiled it by that means; the spirits seeking for a vent, will find it;

and

and the more they are pent, the longer they will be before they are expended; which vent being neglected by the ciderist, becomes a passage for the best spirits of the cider, often to its absolute spoiling.

The common opinion of the sudden decaying or flattening of cider is to be rejected, scarce any drink being more easily preserved than this; and though much of its spirit be lost, yet out of its own body, whilst new, it may be again revived, suffering much more by too soon detaining its spirits than by too lax a closure. Cider pressed from pulpy, or thorough ripe, or mellow, fruit, having lain long in hoard, is not so apt to emit its spirits as the other, and is more easily preserved. Drawing off cider into bottles, and keeping it in them, well stopped, for some time, is a great improver of it. This is done after it is thoroughly purified, and at any time of the year; if it be bottled early, there needs no addition, it having body and spirit enough to retrieve in the bottle what was lost in the barrel; but if it has been over-fermented, and thereby become poor, flat, and eager, then, in the bottling, if you add a small quantity of loaf-sugar, more or less, according as it may require, it will give a new life to the cider, and, probably, make it better than ever it was before, especially if it were but a little acid, and not eager.

Great care is to be had in choosing good corks, much good liquor being absolutely spoiled only through the defect of the cork; therefore glass-stoppers * are to be preferred, in case the accident of breaking the bottles can be prevented. If the corks are steeped in scalding water a short time before you use them, they will comply better with the mouth of the bottle than if forced in dry; also the moisture of the cork does advantage it in detaining the spirits. Therefore, laying the bottles sideways is to be commended, not only for preserving the corks moist, but that the air which remains in the bottle is

* This I cannot recommend as a practice suited to commercial purposes.

on its side, where it can neither transpire, nor can new be admitted, the liquor being against the cork, which not so easily passes through the cork as the air. Some place their bottles on a frame, with their mouths downwards, for that end; which is not so well approved of, by reason that if there be the least settling in the bottle, you are sure to have it in the first glass.

Placing the bottles on a frame, as is usual, or on shelves, is not so good as on the ground, by reason that the farther from the earth they stand, the more subject they are to the variation of the air, which is more rare in the upper part of a cellar or other room, than in the lower; and a few inches will occasion a great change, unless in a room arched or vaulted with stone; but where room is wanted, this inconvenience may be easily put up with. Setting bottles in sand is by many not only made use of, but commended, although without cause, it not adding that coldness to the bottles as is generally expected, being rather of a dry and temperate quality than cold; if there be any convenience in it, it is because it defends them from the too sudden changes of the air into heat or cold, which in open and not deep rooms it is often subject to.

The placing of bottles in cisterns of spring-water, either running or often changed, is without doubt the best way of preserving cider, or any other vinous liquors. A conservatory, made where a recruit of cool refrigerating spring-water may be conveniently had, will preserve cider until it come to the strength of Canary itself. Bottles let down into wells of water where pumps are, that the frequent use of buckets may not injure them; or little vaults made in the sides of wells near the bottom, may supply the defect of spring-water in your cellar. The reason why water is to be preferred for such a conservatory, is, because the closeness of its body admits not of a sudden rarefaction of air, as other materials do, but is generally of an equal degree of coldness, and that colder than commonly the liquor is that is preserved, which

which so condenses its spirits, that they seek not any exition or expansion, but acquiesce in their own proper body, where they multiply and become more and more mature, by virtue of that innate heat the liquor received whilst in its fruit. For by the same reason that cold detains or suppresses the spirits before fermentation that they cannot act, now after fermentation does it keep in the pure and genuine spirit, otherwise apt to exhale, which purifies and enriches the liquor so preserved.

To accelcrate maturity in your bottle-drink, you may place them above stairs in some room warmed by the beams of the sun; which will much hasten its maturity, and is easier performed than any agitation can be; but thus it will not long continue, and caution must be had to your bottles.

Binding down the corks of your bottles in case of danger, is not so much to be commended, as well-fitting them in by full corks; because the liquor were better fly the cork than break the bottle, which must be, in case the cork be tyed down, and the liquor not well qualified.

In many places they boil their cider, adding thereto several spices, which makes it very pleasant, and abates the unsavory smack it contracts by boiling, but withal gives it a high colour. This way is not to be commended, because the juice of the apple is either apt to extract some ill savour from the brass or copper, we being not acquainted with any other vessels to boil it in; or the feces or sediment of it are apt to burn by its adhereing to the sides of the vessel, it being boiled on a naked fire.

This cider, thus boiled and purified to the expence of one-half, will keep very long, and be exceedingly rich and strong, and not so ill-qualified, as has usually been, in case you use caution in the operation,

tion, which is to be preferred to those spicy additions. It many times happens, that cider that has been good, by ill-management or other accidents, becomes dead, flat, sour, thick, muddy, or musty, all which, in some sort or other, may be cured.

Deadness or flatness in cider, which is often occasioned from the too free admission of air into the vessel, for want of tight-stopping, is cured by grinding a small parcel of apples, and putting them in at the bung-hole, and stopping it close, sometimes trying it by opening the small vent, that it force not the vessel; but then you must draw it off in a few days, either into bottles or another vessel, lest the mark corrupt the whole mass; which may also be prevented, if you press your apples, and put only the new Must that comes from them on the decayed cider. The same may be done in bottles, by adding about a spoonful or two of new Must to each bottle of dead cider, and stopping it again. Cider that is dead or flat will oftentimes revive again of itself, if close stopped, upon the revolution of the year and approaching summer.

But cider that has acquired a deadness or flatness, by being kept in a beer or ale vessel, is not to be recovered, the smack of the beer or ale being the only cause of it, and always predominates. Honey, or sugar mixed with some spices, and added to the cider that is flat, revives it much; let the proportion be according to the distemper that requires it. If cider be acid, as is sometimes the case, by reason of the immaturity of the fruit, too quick an operation, too great a fermentation in the vessel, or too warm a situation of the vessels wherein it is kept; this sometimes becomes pleasant again, in case its lee be yet in the vessel, as is supposed by a second operation on it; but if it does not, you may add about a gallon of unground wheat to a hogshead of it, which will very much sweeten it, and make it pleasant. The same effect will two or three eggs, put in whole, or a pound of figs, slit,

slit, produce, as is reported. But the surest remedy is bottling it with a knob of sugar, in proportion to the occasion.

Wheat boiled till it begins to break, and, when cold, added to the cider, but not in too great a quantity, and stirred into it, helps it much; the like does cinnamon-canes, but the vessel must be stopped close in either. There is some difference between a sharp or acid cider, and a cider that is eager or turned. The first has its spirits free and volatile, and may easily be retrieved by a small addition of new spirits, or some edulcorating matter; but the latter has part of its spirits wasted, and part retired, that all additions are vain attempts to recover it.

If your cider be musty, which happens either from the places the fruit lay in before grinding, or from the vessels through which the pulp or Must hath passed, or which the cider is contained in; the cure, therefore, is very difficult. Although, in some measure, the ill-savour of it may be corrected by mustard-seed, ground with some of the same cider. Thick cider is easily cured at what age soever, by exciting it to a fermentation, either by the addition of mustard, made with sack, or a new pulp, or Must, or by purifying it with isinglass, or fish-glue, as is before directed. Racking of cider is much commended by some, but the operation is tedious, troublesome, and costly, by reason of the change of vessels of different sizes, the latter being to be less than the former; and, therefore, not to be endured amongst true ciderists, purifying the liquors before tunning being much to be preferred.

If the vessel, before cider be tunned into it, be fumed with sulphur, it much conduces to the preservation of this, or any other kind of liquor; which may be done by dipping a rag in melted brimstone, prepared after the same manner as before prescribed for scenting the cask, and by a wire letting it down into the vessel, being fired, will

fill

fill the vessel full of smoak; then take it out, and immediately tun up your liquor, which gives it no ill-taste nor savour, and is an excellent preserver of your health, as well as of the liquor.

CIDERKIN, *or water cider*, sufficiently strong for table drink, may be made by adding water to the *cheese pumice*, mashed up with cold water that has been previously boiled, suffered to stand for two days, and pressed on the third; let it be immediately tunned, if prepared from mellow fruit; if not, boil it with some hops, after the manner of brewing table-beer, and then tun it up after standing one night to cool; in this case the previously boiling the water in the first instance may be dispensed with.

Thus far the faithful old author, *Warlidge*; were he as well informed in fermentation and in the other detail of preparing cider, as he is faithful in his description of what he knew, nothing further need be said on the subject.

In making this drink, it hath long been thought necessary in every part of England, to lay the harder cider fruits in heaps for some time before breaking their pulps; but the Devonshire people have much improved this practice; in other counties the method is, to make these heaps of apples in a house, or under some covering, inclosed on every side; this method hath been found defective, because, by excluding the free air, the heat soon became too violent, and a great perspiration ensued, by which, in a short time, the loss of juice was so great as to reduce the fruit to half their former weight, attended with a general rottenness, rancid smell, and disagreeable taste; in the southern parts a middle way has been pursued; to avoid the inconveniencies attending the above, they make their heaps of apples in an open part of an orchard, where, by the means of a free air and less perspiration, the desired maturity is brought about, without any considerable waste of the juices, or decay of the fruit, and intirely free of rankness; and though

though some apples rot even in this manner, they are very few, and are still fit for use, all continue plump and full of juices, and very much heighten the colour of cider, without ill-taste or smell. In pursuing the Devonshire method it is to be observed : first, all the promiscuous kind of apples that have dropped from the trees from time to time, are to be gathered up and laid in a heap by themselves, and be made into cider, after having so lain about ten days : secondly, such apples as are gathered from the tree, having already acquired some degree of maturity, are likewise to be laid in a heap by themselves for about a fortnight : thirdly, the later hard fruit, which are to be left on the trees till the approach of frost is apprehended, are to be laid in seperate heaps, where they are to remain a month or six weeks, by which, notwithstanding frost, rain, &c. their juices will receive such a maturation as will prepare them for a kindly fermentation, and which they could not have attained on the trees by means of coldness of the season.

It is observable, that the riper and mellower the fruits are at the time of collecting them into heaps, the shorter should be their continuance there, and, on the contrary, the harsher, immaturer, and harder they are, the longer they should rest. These heaps should be made in an even and open part of an orchard, without any regard to covering from rain, dews, or what else may happen during the apples staying there, and whether they be carried in and broken in wet or dry weather, the thing is all the same. If it may be objected, that during their having lain together in the heaps, thcy may have imbibed great humidity, as well from thc air, as from the ground, rain, dews, &c. which are mixed with their juices ? The answer is, this will have no other effect than a kindly diluting natural to the fruits, by which means a speedier fermentation ensues, and all heterogeneous humid particles are thrown off. The apples are then ground, and the pumices received in a large open-mouthed vessel, capablc of containing as much thereof as is sufficient for one making, or one cheese, though it

it has been a custom to let the pumice remain some hours in the vessel appropriated to contain it; yet this practice is by no means commendable, for, if the fruits did not come ripe from the trees, or otherwise matured, the pumice remaining in the vat too long, will require such harshness and coarseness from the skins as is never to be got rid of, and if the pumice is of well-ripened fruit, the continuing too long there will occasion it to contract a sharpness that very often is followed with want of spirit and pricking, nay, sometimes it even became vinegar, or always continues of a wheyish colour, all which proceeds from the heat of fermentation that it almost instantly falls into, on laying together; the pumice, therefore, should remain not longer in the vat than until there may be enough broke for one pressing, or that all be made into a cheese and pressed the day it is broken.

In Plate, No. X. is a perspective view of the Cider Press and Apple Mill, A, B, the bottom or lower beam, C D, the upper beam, 5 6 7 8 9, the uprights; 4. 4. *e. e.* spurs; *Z.* 2. 12. braces, or cross pieces; *a b* capatals; X blocks; *g.* the screw; E, the back or receiver; F the cheese or cake of pumice placed on the stage or bason; G, the stage or bason; 10, 10, beams that supports the pieces of which the bason is composed; 11, perpendicular pieces for supporting these beams; H, the buckler; R. S. Q. a circular trough of the apple mill; T. L. V. compartments, or divisions, for different sorts of apples; M, the mill stone; L, M, axis of the mill stone; N, the spring tree bar. *Cider spirit,* is a spiritous liquor drawn from cider by distillation in the same manner as brandy from wine, the particular flavour of this spirit is not the most agreeable, but it may with ease be divested wholly of it and rendered a perfectly pure and insiped spirit upon rectification, the traders in spiritous liquors are well acquanted with the value of such a spirit as this.

The

The stooming or stumming of cider, is done by burning a match or scent in a clean hogshead, moist from recent rincing, and racking the cider on the fret into it. If much on the fret, when the cider is half racked into the matched or scented cask, burn another match in each cask, roll and tumble them well about (if there are no lees) for a couple of hours, and then finish the racking. *Stum* is the rich Must of good cider, blended with the vapour of the burning match or scent, stoomed as above, which prevents its fermenting; and when disposed to fret, must be racked into another cask well matched; if this is neglected, and it once ferments, it is no longer *stum,* but becomes good cider. *Stum* is used to mend declining cider, make it ferment afresh, and give life and sweetness to it, a kind of reanimation. Boiled cider makes the best keeping *stum.*

It would doubtless be a great improvement to many estates to cultivate the land not fit for corn, by planting the proper sorts of apples and pears, for the production of so wholesome and pleasant a beverage as *cider* and *perry.* In the preparation of this very estimable liquor there is no expence of fuel to brew it; and the labour is but once a year, and when sold yields a very encouraging profit. The larger quantities there is made together, the better it succeeds; in large vessels it will keep sound and good for many years. Besides it is a pursuit in which any gentleman can engage, without being considered as a trader, or exposing himself to the operation of the *Bankrupt Laws.* A man may exercise or amuse himself in any manufacture from the produce of his own land, as a necessary or usual mode of reaping or enjoying that produce, and bringing it advantageously to market; and he shall not be considered as a trader, though he buy necessary ingredients or materials to fit it for the market; for this is the way of enjoying the land in cider countries; but where the produce of the land is merely the raw materials of a manufacture, and used as such, and not according to the usual mode of enjoying the land; in short, where the produce of the land is an insignificant article, in comparison of the

whole expence of the manufacture, there he ought to be considered as a trader, so the law decides. *

THE MANUFACTURING OF CIDER AND PERRY

Forms a capital branch in our fruit counties, and of which the improvement must be considered as of great importance to the public, but particularly so to the inhabitants of those districts where these liquors constitute their common beverage.

Cider and Perry, when genuine, and in high perfection, are excellent vinous liquors, and are certainly far more wholesome than many others which are at present in higher estimation. When the Must is prepared from the choicest fruit, and undergoes the exact degree of vinous fermentation requisite to its perfection, the acid and the sweet are so admirably blended with the aqueous, oily, and spirituous principles, and the whole so imbued with the grateful flavour of the rinds, and the agreeable aromatic bitter of the kernels, that it assumes a new character; grows lively, sparkling, and exhilarating; and when completely mellowed by time, the liquor becomes at once highly delicious to the palate, and congenial to the constitution; superior, in every respect, to most other English wines, such (says Dr. Fothergill †) would it be pronounced by all complete judges, were it not for the popular prejudice annexed to it, as a cheap home-brewed liquor, and consequently within the reach of the vulgar. To compare such a liquor with some of the foreign, fiery, sophisticated mixtures, sometimes imported, would be no credit to it; for it certainly surpasses them in flavour and pleasantness, as much as it excels them in cheapness; but rarely do we meet with perry or

* T. Rep. 38. † Bath Papers, v. v. p. 348.

or cider of this superior quality, for what is generally sold by dealers and inn-keepers, is a poor, meagre, vapid, liquor, prone to the acetous fermentation, and, of course, very injurious to the constitution. Is it not very mortifying, after the experience of so many centuries, that the art of preparing those ancient British liquors should still be so imperfectly understood as to seem to be in their very infancy? that, throughout the principal cider districts, the practice should still rest on the most vague undeterminate principles, and that the excellence of the liquor should depend rather on a lucky random hit, than on good management; yet, such appears to be really the case, even among the most experienced cider-makers of Herefordshire and Gloucestershire.

Mr. Marshall, that nice observer of rural affairs, in his late tour* through those counties, (expressly undertaken for the purpose of inquiry on this subject) informs us, that scarcely two of the professional artists are agreed as to the management of some of the most essential parts of the process; that palpable errors are committed, as to the time and manner of gathering the fruit—in laying it up—in neglecting to separate the unsound—and to grind properly the rinds, kernels, &c.—that the method of conducting the vinous fermentation, the most critical part of the operation, and which stamps the future value of the liquor, is by no means ascertained; while some promote the fermentation in a spacious open vat, others repress it by inclosing the liquor in a hogshead, or strive to prevent it altogether; that no determinate point of temperature is regarded; and that the use of the thermometer is unknown, or neglected; that they are as little consistent as to the time of racking off; and whether this ought to be done only once, or five or six times repeated. That for fining down the liquor, many have recourse to that odious article, bullock's blood, when the intention might be much better answered by whites of eggs

* Rural Econ. Gloucestershire, II. p. 308.

or isinglass; and finally, that the capricious taste of particular customers is generally consulted, rather than the real excellence of the liquor, and consequently, that a very imperfect liquor is often vended, which tends to reduce the price, to disgrace the vender, and to bring the use of cider and perry into disrepute.

The art of making vinous liquors is a curious chemical process; and its success chiefly depends on a dextrous management of the vinous fermentation, besides a close attention to sundry minute circumstances, the theory of which is not, perhaps, yet fully understood by the ablest chemists. *

Can we longer wonder then, that so many errors should be committed by illiterate cider makers, totally unversed in the first principles of the chymical art? some few, indeed more enlightened than their brethren, and less bigotted to their own opinions, by dint of observation strike out improvements, and produce a very new thin liquor of superior quality, though perhaps far short of excellence, yet still sufficient to show what might possibly be accomplished by a series of new experiments conducted on rational principles. This might lead to successive improvements, till at length our English fruit liquors might be carried to a pitch of perfection hitherto unknown, by which the demand both at home and abroad would soon be enlarged, the prices augmented according to the quality, the value of estates increased, and the health and prosperity of these counties proportionably advanced. This might also help to point out a method of correcting the imperfections of these liquors, and of meliorating those of a weak meagre quality, by safer and more effectual means than are now practised; and though nothing can fully compensate the defect of sunshine in maturing the saccharine juices in unfavourable seasons, yet probably such liquor might, without the dangerous and expensive

* See Fermentation, under *Brewing*, *Distilling*, *and Foreign Wines*. Books I. II. and IV.

expensive method of boiling in a copper vessel, admit of a considerable improvement by the addition of barm, or other suitable ferment, as yet unknown in the practice of the cider districts, or, perhaps, rather by a portion of rich Must, or some wholesome sweet, as honey, sugar-candy, or even molasses, added in due proportion previous to the fermentation. In fact, it appears from a late publication,* that the Germans are known to meliorate their thin harsh wines by an addition of concentrated Must, not by evaporation, but by freezing. By this simple process they are made to emulate good French wines; a practice worthy of imitation, especially in the northern climates. *See Appendix on Wines.*

The general method of preparing Cider and Perry is very much the same, as may appear from what has been said; but, willing to glean up all the information obtainable, I here insert the observations of more modern authors than Mr. Worlidge, and perhaps not less faithful. The mill † is not essentially different from that of a common tanner's mill for grinding bark; it consists of a mill-stone from two and an half to four feet and an half in diameter, running on its edge on a circular stone trough, from nine to twelve inches in thickness, and from one to two tuns in weight, the bottom of the trough in which this stone runs is somewhat wider than the thickness of the stone itself, the inner side of the groove rises perpendicularly, but the outer bevelled in such a manner as to make the top of the trough six or eight inches wider than the bottom, by which means there is room for the stone to run freely, and likewise for putting in the fruit, and stirring it up while grinding. The bed of a middle-sized mill is about nine feet, some ten, and some twelve, the whole being composed of two, three, or four stones, cramped together, and finished after being cramped in this manner; the best stones are found in the forest of Dean, generally a dark reddish gritstone, not calcarious, for if it were of a calcarious quality, the acid juice of the fruits would act upon it and

* Sir Edward Barry, bart. on Wines.

† See Plate, No. X.

and spoil the liquor; a clean-grained grindstone grit is the fittest for the purpose; the runner is moved by means of an axle passing through the centre, with a long arm reaching without the bed of the mill, for a horse to draw by; on the other side is a shorter arm, passing through the centre of the stone, as represented in the figure. An iron bolt, with a large head, passes through an eye in the lower part of the swivel on which the stone turns into the end of the inner arm of the axis; and thus the double motion of it is obtained, and the stone kept perfectly upright. There ought also to be fixed on the inner arm of the axis, about a foot from the runner, a cogged wheel, working in a circle of cogs, fixed upon the bed of the mill; the use of these is to prevent the runner from sliding, which it is apt to do when the mill is full; it likewise makes the work more easy for the horse; these wheels ought to be made with great exactness. Mr. Marshall observes, that it is an error to make the horse draw by traces. "That acting point of draught, (says he) the horse's shoulders, ought, for various reasons, to be applied immediately at the end of the arm of the axis, not two or three yards before it, perhaps of a small mill near one-fourth of its circumference." The building in which the mill is inclosed ought to be of such a size that the horse may have a path of three feet wide betwixt the mill and the wall, so that a middling sized mill, with its horse-path, takes up a space of fourteen or fifteen feet every way. The whole dimensions of the mill-house, according to our author, to render it any way convenient, are twenty-four feet by twenty; it ought to have a floor thrown over it at the height of seven feet, with a door in the middle of the front, and a window opposite, with the mill on one side and the press on the other side of the window, the latter must be as near the mill as convenience will allow, for the more easy conveying the ground fruit from the one to the other. The press, of which the principle will be understood from the figure, has its bed or bottom about five feet square; this ought to be made entirely either of wood or of stone; the practice of covering it with lead being now universally known to be

be pernicious. It has a channel cut a few inches within its outer edges, to catch the liquor as it is expressed, and convey it to a lip formed by a projection on that side of the bed opposite the mill, having under it a stone trough or wooden vessel, sunk within the ground, when the bed is fixed low, to receive it. The press is worked with levers of different lengths, first a short, and then a moderately long one, both worked by hand; and lastly, a bar, eight or nine feet long, worked by a capston or windlass; the expence of fitting up a mill-house is not very great. Mr. Marshall computes it from twenty, to twenty-five pounds, and on a small scale from ten, to fifteen pounds, though much depends on the distance and carriage of the stone; when once fitted up will last many years.

The making of the Fruit Liquors under consideration requires an attention to the following particulars:

I. The fruit. II. The grinding. III. Pressing. IV. Fermenting. V. Correcting. VI. Laying up. VII. Bottling. Each of which heads is subdivided into several others.—

I. In the management of the fruit, the following particulars are to be considered:

1. *The time of gathering;* which varies according to the nature of the fruit. The early pears are fit for the mill in September; but few apples are ready for gathering before Michaelmas; though, by reason of accidental circumstances, they are frequently manufactured before that time; for sale cider and keeping drink, they are suffered to hang upon the trees till fully ripe; and the middle of October is generally looked upon to be a proper time for gathering the stire apples. The criterion of a degree of ripeness is the fruit falling from the tree; and to force it away before that time, in Mr. Marshall's opinion, is robbing it of some of its most valuable particles; "the harvesting of fruit

fruit (says he) is widely different in this respect from the harvesting of grain, which has the intire plant to feed it after the separation from the soil; while fruit, after it is severed from the tree, is cut off from all possibility of a further supply of nourishment; and although it may have reached its wonted size, some of its more essential particles are undoubtedly left behind in the tree." Sometimes, however, the fruits which are late in ripening are apt to hang on the tree until spoiled by frosts, though week watery fruits seem to be most injured in this manner; and Mr. Marshall relates an instance of very fine liquor being made from golden pippins, after the fruit had been frozen as hard as ice.

2. *The method of gathering.* This, as generally practised, is directly contrary to the principles laid down by Mr. Marshall, *viz.* beating them down with long slender poles. An evident disadvantage of this method is, that the fruit is of unequal ripeness, for the apples on the same tree will differ many days, perhaps even weeks of their time of coming to perfection, whence some part of the richness and flavour of the fruit will be effectually and irremediably cut off. Nor is this the only evil to be dreaded; for as every thing depends on the fermentation it has to undergo, if this be interrupted, or rendered complex, by a mixture of ripe and unripe fruits, and the liquor be not, in the first instance, sufficiently purged from its fecculencies, it is difficult to clear the liquor afterwards. The former defect the cider-makers attempt to remedy, by a mixture of brown sugar and brandy, and the latter by bullock's blood and brimstone; but neither of these can be expected to answer the purpose very effectually. The best method of avoiding the inconveniencies arising from an unequal ripening of the fruit is, to go over the trees twice, once with a hook when the fruit begins to fall spontaneously; the second time when the latter are sufficiently ripened, or when the winter is likely to set in, when the trees are to be cleared with the poles above-mentioned.

3. *Maturing*

3. *Maturing the gathered fruit.* This is usually done by making it into heaps, as is mentioned under the article of cider; but Mr. Marshall intirely disapproves of the practice, because, when the whole are laid in a heap together, the ripe fruit will begin to rot before the other has arrived at that degree of artificial ripeness which it is capable of acquiring, "the due degree of maturation of fruit for liquor, he observes, is a subject about which men, even in this district, differ much in their ideas. The prevailing practice of gathering into heaps until the ripest begin to rot, is wasting the best of the fruit, and is by no means an accurate criterion. Some shake the fruit, and judge by the rattling of the kernels; others cut through the middle, and judge by their blackness, but none of these appear to be a proper test. It is not the state of the kernels, but of the flesh; not of a few individuals, but of the greater part of the prime fruit, which renders the collective body fit or unfit to be sent to the mill; the most rational test of the ripeness of the fruit is, that of the flesh having acquired such a degree of mellowness, and its texture such a degree of tenderness, as to yield to moderate pressure, thus, when the knuckle or the end of the thumb can with moderate exertion be forced into the pulp of the fruit, it is deemed in a fit state for grinding."

4. *Preparation for the mill.* The proper management of the fruit is to keep the ripe and unripe fruit separate from each other; but this cannot be done without a considerable degree of labour, for as, by numberless accidents, the ripe and unripe fruit are frequently confounded together, there cannot be any effectual method of separating them except by hand; and Mr. Marshall is of opinion, that this is one of the grand secrets of cider-making, peculiar to those who excel in the business; and he is surprised that it should not before this time have come into common practice.

5. *Mixing fruit for liquor.* Our author seems to doubt the propriety of this practice, and informs us, that the finer liquors are made

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from select fruits, and he hints, that it might be more proper to mix liquors after they are made, than to put together the crude fruits. *

II. Grinding, and Management of the Fruit when Ground.

1. For the greater convenience of putting fruit into the mill, every mill should have a fruit chamber over it, with a trap door to lower the fruit down into the mill. The best manner in which this can be accomplished is to have the valve over the bed of the mill, and furnished with a hose or tunnel reaching down to the trough in which the stone moves; no straw is used in the lofts, but sometimes the fruit is turned. In Herefordshire it is generally believed, that grinding the rinds and seeds of the fruit, as well as the fleshy part to a pulp, is necessary towards the perfection of the cider, whence it is necessary that every kind of pains should be taken to perform the grinding in the most perfect manner. Mr. Marshall complains, that the mills are so imperfectly finished by the workmen, that for the first fifty years † they cannot perform their work in a proper manner. Instead of being nicely fitted to one another with the square and chisel, they are hewn over with a rough tool, in such a careless manner that horse-beans might lie in safety in their cavities. Some even imagine that to be an advantage, as if the fruit was more effectually and completely broken by rough than smooth stones. Some use fluted rollers of iron, but these will be corroded by the juice, and thus the liquor might be tinged. Smooth rollers will not lay hold of the fruit sufficiently to force it through.

Another improvement requisite in the cider mills, is to prevent the matter in the trough from rising before the stone in the last stage of grinding, and a method of stirring it up in the trough more effectually than can be done at present. To remedy the former of these defects, it

* A practice he will find warranted in the preceding books of this Treatise.

† Probably fifteen.

it might perhaps be proper to grind the fruit first in the mill to a certain degree; and then put it between two smooth rollers to finish the operation in the most perfect manner. It is an error to grind too much at once, as this clogs up the mill, and prevents it from going easily. The usual quantity for a middle sized mill is a bag, containing four corn bushels; but our author had an opportunity of seeing a mill in which only half a bag was put; and thus the work seemed to go on more easily as well as more quickly, than when more was put in at once. The quantity put in at one time is to be taken out when ground. The usual quantity of fruit ground in a day is as much as will make three hogsheads of perry or two of cider.

2. *Management of the ground fruit.* There Mr. Marshall condemns in very strong terms the practice of pressing the pulp of the fruit as soon as the grinding is finished, because thus neither the rind nor seeds have time to communicate their virtues to the liquor, or to extract these virtues in the most proper manner; some allow the ground fruit to lie twenty-four hours or more after grinding, and even regrind it, in order to have, in the most perfect manner, the flavour and virtues of the seeds and rind.

III. Pressing the Fruit, and Management of the Residuum.

This is done by folding up the ground fruit in pieces of hair-cloth, and piling them up above one another, in a square frame or mould, and then pulling down the press upon them, which squeezes out the juice, and forms the matter into thin and almost dry cakes. The first runnings come off foul and muddy, but the last, especially in perry, will be as clear and fine as if filtered through paper. It is common to throw away the residuum as useless; sometimes it is made use of, when dry, as fuel; sometimes the pigs will eat it, especially when not thoroughly squeezed, and sometimes it is ground a second time with water, and pressed for an inferior kind of liquor used for the family.

family. Mr. Marshall advises to continue the pressure as long as a drop can be drawn. "It is found (says he) that even by breaking the cakes of the refuse with the hands only, gives the press fresh power over it; for, though it has been pressed to the last drop—a gallon or more of additional liquor may be got by this means; regrinding them has a still greater effect; in this state of the materials, the mill gains a degree of power over the more rigid parts of the fruits, which in the first grinding it could not reach. If the face of the runner, and the bottom of the trough, was dressed with a broad chisel, and made true to each other, and a moderate quantity of residuum ground at once, scarcely a kernel could escape unbroken, or a drop of liquor remain undrawn."

But though the whole virtue of the fruit cannot be extracted without grinding it very fine, some inconveniences attends this practice, as a part of the pulp thus gets through the hair-cloth, and may perhaps be injurious to the subsequent fermentation. This, however, may be in a great measure remedied, by straining the first runnings through a sieve; the whole should also be allowed to settle in a cask, and drawn off into a fresh vessel previous to the commencement of the fermentation; the reduced fruit ought to remain some time between the grinding and pressing, that the liquor may have an opportunity of forming an extract with the rind and kernels; but this must not be pushed too far, as in that case the colour of the cider would be hurt; and the most judicious managers object to the pulp remaining longer than twelve hours, without pressure; "thence (says our author) upon the whole, the most eligible management in this stage of the process appears to be this; grind one pressful a day; press, and regrind the residuum in the evening; infuse the reduced matter all night among part of the first runnings, and in the morning repress, while the next pressful is grinding.

IV. Fermentation.

IV. Fermentation. The common practice is, to have the liquor tunned, that is, put into casks or hogsheads immediately from the press, and to fill them quite full; but it is undoubtedly more proper to leave some space empty to be filled up afterwards. * No accurate experiment has been made with regard to the temperature of the air proper to be kept up in the place where the fermentation goes on.

Frost is prejudicial; but when the process usually commences, that is, about the middle of October, the liquor is put into airy sheds, where the warmth is scarce greater than in the open atmosphere; nay, they are frequently exposed to the open air without any covering farther than a piece of tile or flat stone over the bung-hole, propped up by a wooden pin on one side to cause the rain water to run off. In a complete manufactory of fruit liquor, the fermenting room should be under the same roof with the mill house, a continuation of the press room, or at least opening into it, with windows or doors on every side, to give a free admission of air into it, with sufficient defence against frost; † fruit lofts over it, and vaults underneath, for laying up the liquors after fermentation, with small holes in the crown of the arch to admit a hose or pipe for the purpose of conveying the liquors occasionally from the one to the other.

In making of fruit liquors no ferment is used, as in making of beer; though, from Mr. Marshall's account of the matter, it seems far from being unnecessary. Owing to this omission, the time of *the commencement* of the fermentation is entirely uncertain; it takes place sometimes in one, two, or three days, sometimes not in a week or a month after tunning; but it has been observed, that liquor which has been agitated in a carriage, though taken immediately from the press,

* This is a practice I by no means recommend. See keeping the casks full at cleansing, under Brewing, Book I.

† As in the Distillers Back Room. See Distilling, Book II.

press, will sometimes pass almost immediately into a state of fermentation. The continuance of the fermentation is no less uncertain than the commencement of it. * Liquors, when much agitated, will go through it perhaps in one day; but when allowed to remain at rest, the fermentation commonly goes on two or three days, and sometimes five or six. The fermenting liquor, however, puts on a different appearance, according to circumstances; when produced from fruits properly matured, it generally throws up a thick scum, resembling that of malt liquor, and of a thickness proportioned to the species and ripeness of the fruit; the riper the fruit, the more scum is thrown up. Perry gives but little scum, and cider will also sometimes do the same; sometimes it is intentionally prevented from doing it.

After having remained some time in the fermenting vessel, the liquor is racked or drawn off from the lees, and put into fresh casks. In this part of the operation also Mr. Marshall complains greatly of the little attention that is paid to the liquor. The ordinary time for racking perry is before it has done hissing, or sometimes when it begins to emit fixed air in plenty. † The only intention of the operation is to free the liquor from its feces, by a cock placed at a little distance from the bottom, after which the remainder is to be filtered through a canvas or flannel bag; this filtered liquor differs from the rest in having an higher colour, having no longer any tendency to ferment, but, on the contrary, checking the fermentation of that which is racked off; and if it loses its brightness, it is no longer easily recovered. A fresh fermentation usually commences after racking, and if it become violent, a fresh racking is necessary in order to check it,

* See Fermentation, Books I. and II.

† The hydrometer should be the only rule adopted for regulating the fermentation. See its operation in Books I. and II.

it, in consequence of which the same liquor will perhaps be racked off five or six times; but if only a small degree of fermentation takes place, which is called fretting, it is allowed to remain in the same cask, though even here the degree of fermentation, which requires racking, is by no means determined. Mr. Marshall informs us, that the best manufacturers, however, repeat the rackings until the liquor will lie quiet, or nearly so; or, if it be found impracticable to accomplish this by the ordinary method of fermentation, recourse must be had to fumigation with sulphur, which is called stumming the casks. For this fumigation, it is necessary to have matches made of thick linen cloth, about ten inches long, and an inch broad, thickly coated with brimstone for about eight inches of their length. The cask is then properly seasoned, and every vent, except the bung-hole, tightly stopped; a match kindled is lowered down into the cask, and held by the end undipped until it be well lighted, and the bung driven in; thus suspending the lighted match within the cask. Having burnt as long as the contained air will supply the fire, the match dies, the bung is raised, the remnant of the match drawn out, and the cask suffered to remain before the liquor is put into it for two or three hours, more or less, according to the degree of power the sulphur ought to have. The liquor retains a smell of the sulphureous acid; but this goes off in a short time, and no bad effect is ever observed to follow.

In some places the liquor is left to ferment in open casks, where it stands till the first fermentation is pretty well over; after which, the froth or yeast collected upon the surface is taken off, it being supposed that it is this yeast mixing with the clear liquor which causes it to fret after racking. The fermentation having totally ceased, and the lees subsided, the liquor is racked off into a fresh cask, and the lees filtered, as above directed. Our author mentions a way of fermenting fruit liquors in broad shallow vats, not less than five feet in diameter, and little more than two feet deep, each vat containing about

about two hogsheads. In these the liquor remains until it has done rising, or till the fermentation has nearly ceased; when it is racked off without skimming, the critical juncture being caught before the yeast falls, the whole sinking gradually together as the liquor is drawn off. In this practice also the liquor is seldom drawn off a second time.

Cider is made of three different kinds, *viz.* rough, sweet, and of a middle richness. The first kind, being usually destined for common use, is made with very little ceremony; if it is but *zeyder*, (says Mr. Marshall) and has body enough to keep, no matter for the richness and flavour. The rougher it is, the further it will go, and the more acceptable custom has rendered it, not only to the workmen but to their masters. A palate accustomed to sweet cider, would judge the rough cider of the farm-houses to be a mixture of vinegar and water, with a little dissolved allum to give it roughness. The method of producing this austere liquor is, to grind them in a crude, under-ripe state, and subject the liquor to a full fermentation; for the sweet liquor, make choice of the sweeter fruits, mature them fully, and check the fermentation of the liquor. To produce liquors of a middle richness, the nature of the fruit, as well as the season in which it is matured must be considered. The fruits to be made choice of are such as yield juices capable of affording a sufficiency both of richness and strength; though much depends on a proper management.* Open vats, in our author's opinion, are preferable to close vessels; but if casks are used at all, they ought to be very large, and not filled; nor ought they to lie upon their sides, but to be set on their ends, with their heads out, and to be filled only to such a height as will produce the requisite degree of fermentation; but in whatever way the liquor be put to ferment, Mr. Marshall is of opinion, that the operation ought to be allowed to go on freely for the first time,

* This practice is condemned in the preceding Book, which had better be consulted.

time, though after being racked off, any second fermentation ought to be prevented as much as possible.

V. Correcting, *provincially called Doctoring.* The imperfections which art attempts to supply in these liquors are, 1. Want of strength. 2. Want of richness. 3. Want of flavour. 4. Want of colour and brightness.

The want of strength is supplied by brandy, or any other spirit, in sufficient quantity to prevent the acetous fermentation. The want of richness is supplied by what are generally termed *sweets*, but prepared in a manner, which our author says has never fallen within his notice. To supply the want of flavour, an infusion of hops is sometimes added, which is said to communicate an agreeable bitter, and at the same time a fragrance; whence it becomes a substitute for the juices of the rinds and kernels thrown away to the pigs and poultry, or otherwise wasted. The want of colour is sometimes supplied by elder-berries, but more generally by burnt sugar, which gives the desired colour, and a degree of bitter which is very much liked; the sugar is prepared either by burning it on a salamander, and suffering it to drop as it melts, or by boiling it over the fire (in which case brown sugar is to be used) until it acquire an agreeable bitter, * then pouring in boiling water, in the proportion of a gallon to two pounds of sugar, and stirred until the liquor become uniform; a pint of this preparation will colour a hogshead of cider. Brightness is obtained by a mixture of the blood of bullocks or sheep, that of swine being rejected, though it does not appear to be more unfit for the purpose than either of the other two; the only thing necessary to be done here is to stir the blood well as it is drawn from the animal, to prevent the parts from separating, and it ought to be stirred both ways for

* See Colouring, under Brewing, Book I.

for a quarter of an hour; the liquor, however, is not always in a proper condition for being refined with this ingredient, on which account, a little of it ought frequently to be tried in a phial; a quart, or less, will be sufficient for a hogshead; after the blood is poured in, the liquor should be violently agitated, to mix the whole intimately together; this is done by a stick slit into four, and inserted into the bung-hole, working it briskly about in the liquor until the whole be thoroughly mixed; in about twenty-four hours the blood will have subsided, and the liquor ought instantly to be racked off, as by remaining upon the blood, even for two or three days, it will receive a taint not easily to be got rid of. It is remarkable, that this refinement with the blood carries down not only the faeces, but the colour also, rendering the liquor, though ever so highly coloured before, almost as limpid as water. Isinglass and eggs are sometimes made use of in refining cider, as well as wine

VI. Laying up, or shutting up the cider in close casks, according to Mr. Marshall, is as little understood as any of the rest of the parts, the bungs being commonly put in at some certain time, or in some particular month, without any regard to the state the liquor itself is in. "The only criterion (says he) I have met with for judging the critical time for laying up, is when a fine white cream-like matter first begins to form upon the surface. But this may be too late; it is probably a symptom at least of the vinous fermentation, which, if it take place in any degree, must be injurious; yet, if the casks be bunged tight, some criterion is necessary; otherwise, if the vinous fermentation have not yet finally ceased, or should recommence, the casks would be endangered, and the liquor injured.—Hence, in the practice of the most cautious manager, whose practice I have had an opportunity of observing, the bungs are first driven in lightly, when the liquor is fine, and the vinous fermentation is judged to be over; and some time afterwards, when all danger is past, to fill up the casks, and drive the bung securely with a rag, and rosin them over at top.—

Most

Most farmers are of opinion, that after the liquor has done fermenting, it ought to have something to feed upon; that is, to prevent it from running into the acetous fermentation. For this purpose, some put in parched beans; others, egg-shells; some, mutton-suet, &c. Mr. Marshall does not doubt that something may be useful, and thinks that isinglass may be as proper as any thing that can be got.

VII. Bottling. This depends greatly on the quality of the liquors themselves; good cider can seldom be bottled with propriety until a year old; sometimes not till two. The proper time is when it has acquired the utmost degree of richness and flavour in the casks; and this it will preserve for many years in bottles. It ought to be quite fine at the time of bottling, or if not so naturally, ought to be fined artificially with isinglass and eggs.

The liquor called ciderkin, purre, or perkin, is made of the mark, or gross matter remaining after the cider is pressed out. To make this liquor, the mark is put into a large vat, with a proper quantity of boiled water, which has stood till it is cold again; if half the quantity of water be used that there was of cider, it will be good; if more, the ciderkin will be small. The whole is left to infuse forty-eight hours, and then well pressed; what is squeezed out by the press is immediately tunned up and stopped; it is fit to drink in a few days. It clarifies of itself, and serves in families instead of small beer. It will keep, if boiled after pressing with a convenient quantity of hops.

We must not conclude this subject without particular notice of the liquor called *cider-wine*, which is made from the juice of the apples taken from the press and boiled; and which, being kept three or four years, is said to resemble Rhenish. The method of preparing this wine, as communicated by Dr. Rush, of America, where it is much practised, consists in evaporating in a brewing copper the fresh apple-

 juice,

juice, till half of it be evaporated; the remainder is then immediately conveyed into a wooden cooler, and afterwards put into a proper cask, with an addition of yeast; and is fermented in the ordinary way. The process has been evidently borrowed from what has long been practised on the recent juice of the grape, under the term of *vina cotta,* or boiled wine, not only in Italy, but also in the islands of the Archipelago, from time immemorial.

This process has lately become an object of imitation in the cider counties, and particularly in the west of England, where it is asserted, that many hundred hogsheads of this wine have been already made; and, it is said to betray no sign of an impregnation of copper by the usual chemical tests; it is considered as perfectly wholesome, and is accordingly drank without apprehension by the common people. Others, however, suspect its innocence; whence it appeared an object of no small moment to determine, in so doubtful a matter, whether or not the liquor acquires any noxious quality from the copper in which it is boiled. With this view Dr. Fothergill made a variety of experiments, and the result seemed to afford a strong presumption, that the cider-wine *does* contain a minute impregnation of copper; not very considerable indeed; but yet sufficient, in the Doctor's opinion, to put the public on their guard concerning a liquor that comes in so very " questionable a shape."

It is a curious chemical fact, he observes, if it be really true, that acid liquors, while kept boiling in copper vessels, acquire little or no impregnation from the metal, but presently begin to act upon it when left to stand in the cold. Can this be owing to the agitation occasioned by boiling, or the expulsion of the ærial acid? Atmospheric air powerfully corrodes copper, probably through the intervention of the ærial, or rather nitrous, acid; for both are now acknowledged to be present in the atmosphere; but the latter is doubtless a much stronger menstruum of copper than the former.

In

In the present process, the liquor is properly directed to be passed into a wooden cooler as soon as the boiling is completed. But as all acids, and even common water, acquire an unpleasant taste from standing in copper vessels in the cold, why may not the acid juice of apples act in some degree on the copper before the boiling commences? Add to this, that brewing coppers, without far more care and attention than is generally bestowed on them in keeping them clean, are extremely apt to contract verdigris, (a rank poison) as appears from the blue or green streaks, very visible when these vessels are minutely examined; should the unfermented juice be thought incapable of acting on the copper, either in a cold or boiling state, yet no one will venture to deny its power of washing off, or dissolving verdigris already formed on the internal surface of the vessel. Suppose only one-eighth part of a grain of verdigris to be contained in a little of this wine—a quantity that may elude the ordinary tests, * and that a bottle should be drank daily by a person without producing any violent symptom of internal uneasiness; yet, what person in his senses would knowingly choose to hazard the experiment of determining how long he could continue even this quantity of a slow-poison, in his daily beverage with impunity? † And yet, it is to be feared, that the experiment is but too often unthinkingly made, not only with cider-wines, but also with many of the foreign wines, prepared by a similar process; for the grape-juice, when evaporated in a copper-vessel, under the denomination of *vino cotto,* or boiled wine, cannot but acquire an equal, if not yet stronger impregnation of the metal than the juice of apples; seeing verdigris itself is manufactured

* The one-hundredth part of a grain may be discovered in a quart, by adding a few drops of volatile alkali to a glassful, which will immediately strike a blue, darker or lighter, in proportion to the impregnation; a quantity too minute to do any injury.

† Must of cider or wine, above the heat of the atmosphere, does not act on the copper as a solvent.

tured merely by the application of the acid husks of grapes to plates of copper.*

Independent of the danger of any metallic impregnation, the Doctor thinks it may be justly questioned, how far the process of preparing boiled wines is necessary, or reconcileable to reason or economy. The evaporation of the Must by long boiling, not only occasions an unnecessary waste of both liquor and fuel; but also dissipates certain essential principles, without which the liquor can never undergo a complete fermentation, and without a complete fermentation there can be no perfect wine. Hence the boiled wines are generally crude, heavy, and flat, liable to produce indigestion, flatulency, and diarrhœas. If the evaporation be performed hastily, the liquor contracts a burnt, empyreumatic taste, as in the present instance; if slowly, the greater is the danger of metallic impregnation. For the process may be presumed to be generally performed in a vessel of brass or copper, as few families possess any other that is sufficiently capacious; nor can a vessel of cast-iron, though perfectly safe, be properly recommended for this purpose, as it would probably communicate a chalybeate taste and dark colour to the liquor. At all events, brass and copper vessels ought to be entirely banished from this and every other culinary purpose.

Perry, a most wholesome pleasant liquor of the cider kind; some of which is so excellent as to pass for champaign in taverns and other places of public resort; indeed more wines than it have been imitated with cider and perry, particularly by the *Hollanders*, and sometimes by the *Flemings*. Dr. Hally observes, that the London market alone took off upwards of twenty thousand hogsheads of Devonshire cider annually. It was in the year 1721 he made this remark, and then suggested it was not all sold as cider. Whether the demand has increased I cannot

* This is admitted;—but it does not act on the copper until a state of acessence.

I cannot say. I have drank in *Flanders* some perry that might pass on ordinary judges for mantling champaign. Perry is prepared from pears in the same manner cider is from apples. The harsher sorts of pears make the best perry. They are infinitely too harsh and acerb or tart, for eating, so much so that even hungry swine reject them. The most esteemed for the purpose are the Bosbury pear, the Bauland, and the horse pear in *Worcestershire;* and the squash pear, as it is called, in *Gloucestershire;* in both which counties, as well as in some of the adjacent parts, they are planted in the hedgerows, and most common fields. There is this advantage attending pear-trees, that they will thrive on land where apples will not so much as live, and that some of them grow to such a size, that a single pear-tree, particularly of the Bosbury and the squash kind, has frequently been known to yield in one season, from one to four hogsheads of perry. The Bosbury pear is thought to yield the most lasting and most vinous liquor. The John-pear, the Harpary-pear, the Drake-pear, the Mary-pear, the Lullum-pear, and several others of the harshest kind, are esteemed the best for perry, and the redder or more tawney they are, the more they are preferred. Pears as well as apples should be full ripe before they are ground. Crab-apples are frequently mixed with the pears, and are said to improve the *Perry*.

End of Book III.

APPENDIX:

OR, A

SUPPLEMENTARY DISSERTATION

ON THE

GROWTH, OR CULTURE, GATHERING, PRESSING, FERMENTING,

PARTING, OR MAKING-UP;

WITH THE NATURE, SALUBRITY, AND USE, OF THE FLAVOURING, COLOURING, AND FINING INGREDIENTS, MADE USE OF IN THE PREPARATION OF

German, French, Spanish, Portugal, Italian, & Grecian,

WINES,

IN THEIR RESPECTIVE COUNTRIES;

Fully describing the best Manner of managing them here,

AND SHEWING THAT FEW, OR NONE OF THEM, ARE INIMITABLE IN THESE KINGDOMS;

WITH THE

PRACTICABILITY OF EFFECTUALLY IMITATING THEM, AND THE

BRANDIES AND VINEGARS

PRODUCED FROM THEM, WITH UNQUESTIONABLE CERTAINTY OF SUCCESS, TO GREAT ADVANTAGE, BY MEANS OF THE COMMON UTENSILS NOW USED BY

SWEET-MAKERS, DISTILLERS, VINEGAR-MAKERS, WINE AND BRANDY MERCHANTS,

AND WITH VERY TRIFLING ALTERATION OR ADDITION.

SIDNEY, Printer, Northumberland-Street, Strand.

FOREIGN WINES, BRANDIES, AND VINEGARS.

GENERAL REMARKS.

By Wine, which is the most safe and sanative cordial bestowed on man, is here meant the juice of the grape; of which, in the language of the poet, we may truly say,

> Sure Heaven left this gen'rous plant uncurst,
> To shew how all things were created first!

To remove prejudices propagated against the salubrity of this superior fluid, and the misrepresentations disseminated by some authors, were my motives for adding this Appendix to the preceding Work. Most of the former writers on this subject were as grossly ignorant of the doctrine of fermentation as they appear to have been of the subsequent treatment and making-up of Wines for exportation; and of the management of them on their arrival at the place where they were destined to be consumed; they were devoid of the requisite knowledge how to prevent or remedy the accidents and deteriorations incident to them, whether arising from the soil, culture, and growth of the vine; the changes and miscarriages of the seasons; the gathering, picking, and preparing the grapes for the press; the variety of ways in which the fruit is managed preparatory to its being pressed, and the various modes of treating the Must, to diversify their quality; which, no doubt, embrace a more extensive

knowledge of the subject than has yet appeared in the English language.

The method of preparing, fermenting, and making up the Wines most in use in these and the neighbouring kingdoms, and the manner of treating them to the greatest advantage on their arrival here, have been extracted from a mass of materials, the aggregate of many years research, and much experience, collected in the different countries enumerated; or from the information of liberal, intelligent, and well-informed men, either planters, merchants, or dealers, and very often the result of all these several channels of information combined; in order to make it a comprehensive system on the Doctrine of Fermentation; with the desire of rendering it as generally useful as the improved state of our present knowledge in chemistry, commerce, and the arts permits.

The very rapid progress of improvement in Natural Philosophy and Chemistry, as applicable to Agriculture, Commerce, and the Arts, should indeed enable us to correct abuses, detect frauds, and expose the artifices which some men had been selfish and wicked enough, not only to attempt, but to propagate. The legislative power in this country, and the authority of government in others, to punish the delinquency of such men, may have nearly abolished abuses of this nature, and the present more noble motive, the establishment of a fair and honourable character, will, it is hoped, totally explode them from every liberal and enlightened nation which make this fluid either an article of culture or commerce.

Indeed, neither the vintager nor the merchant of the present day, nor scarcely of any former period, could be implicated in the preceding observations. The rivalship in each, and the principle that has in general actuated both, not only precluded unfair practices, but rendered them impolitic, and unworthy the character of such men.

The

The English merchants, and their commercial correspondents settled in the different wine countries, distinguished for probity and honour throughout Europe, have not only added to the credit, support, and protection, but to the wealth, greatness, and splendour of the nation; these men would spurn the idea of such abuses.

No: it was to an inferior class of men, created by them, known by the appellation of vintners and wine-coopers, to whom the management of wines were at one time very fully committed, that the abuses in this, or any of the wine countries were ascribable. Even the practices of these men have been exaggerated and misrepresented by some authors, who, after copying the absurdities of their predecessors, gleaned up all the extraordinary, false, and frivolous items, with traditionary stories of sophistications and diseases in wines that never existed, and of additions and cures which never had, nor could have been applied; instead of taking things as they really were, and propagating useful facts. The wine-coopers of the present day are not, nor could not, in general, be implicated in these strictures; and the vintners, now, are a very different class of men to what they were then.

Such was the state of things in Europe until the German Chemists, to their immortal honour, made a rational enquiry into the nature and quality of wines, and this too in a way that served as a clue to future investigation. The more modern researches into the culture, growth, and preparation of wines, have been followed up by the French, whose philosophers and chemists, with their usual ability and candour, have thrown great light on the Doctrine of Fermentation, and the treatment of Wines, Brandies, and Vinegars.

In default of more able hands taking up the subject in these kingdoms, I have ventured to give the result of my observations and enquiries, with a view to assist those gentlemen engaged in the culture

or

or commerce of wines; to which I was the more encouraged from finding very little of the ground preoccupied. The alacrity with which they embraced and supported my undertaking, will, I hope, apologise for the attempt.

If I have brought a greater number of facts into one point of view, than has fallen within the observation of those gentlemen to whose liberal patronage I am indebted, and with whose information I have sedulously enriched the work; if, by exposing the frauds, and guarding against the abuses of a few selfish and wicked men, I have served the community; or by pointing out the sanative qualities and beneficial effects of the different wines in use, distinguishing their respective application; and described the danger and impolicy of their immoderate use, with their advantages as a cordial or a remedy, and their curative indication in a variety of diseases, so as to increase their use, and prevent their abuse, I shall enjoy the high gratification of adding something to the common stock of useful knowledge on this important subject, and my views will be most satisfactorily answered.

Throughout the whole of the work I have as cautiously as I could, consistently with truth, avoided hurting the feelings, or reproaching the conduct of any class of men.

The Vine was no doubt cultivated in the earliest ages of the world. Moses, in sacred history, informs us, that Noah was intoxicated with Wine, probably not many years after he had quitted the ark. The immoderate use of this superior fluid, it is hoped, could not have contributed to the vices of the antideluvians, which the sacred historian ascribes to them as the cause of their being extirpated by the flood.

The

The admired wisdom of Mahomet in after ages, so strongly manifested in making it an article of religious faith in the Alcoran, that his followers or believers should not drink any wine, from finding them disobedient and ungovernable when intoxicated with it:—must be allowed, was a remarkable stroke of good policy in a man, who combined in himself the great and extraordinary offices of general, prophet, and law-giver, to enact under those circumstances, "Thou shalt drink no wine;" and though a precaution well calculated to secure good order and obedience in an army of religious fanatics, would be a precedent unworthy the imitation of rational and enlightened people. Were it not adhered to as an article of their faith, they would have been a more healthy race of people, and probably not subject to the plague, so much more fatal to them than to their neighbours, who indulge in the liberal use of this sanative, tonic, and antiseptic beverage. This should be a useful hint to all who come among them not to follow their example, lest they should share in their fate; which I have more fully enlarged upon in my Medical Observations on the Diseases of Hot Climates, where I have practically demonstrated the salutary use of wine, and other fermented liquors, in counteracting the deleterious maladies so destructive in our fleets and armies, by its checking the sceptic degeneracy of the animal fluids in these regions of mortality.

Ancient historians mention, that the Asiatics first learned the art of cultivating the vine from the Egyptians; the Grecians from the Asiatics; and the Romans from the Greeks. These two last nations certainly understood the art of cultivating the vine, and the most judicious mode of preparing and managing their wines; and their philosophers and physicians the healthful and medicinal application of them.

Of all the inestimable products of nature, there is probably none more numerous in its species, or diversified in its qualities than this divine

divine plant. One of the greatest blessings bestowed on man by the great all-wise Creator of the Universe; the highest luxury in nature, both in the delicious quality of its fruit, as a food, and the exquisite delicacy of its wine, as a drink.

God crowns with grapes the cluster'd vine,
To cheer man's heart, oppress'd with care;
Gives Oil that makes the face to shine,
And Corn that wasted strength repair.

The great variety of kind, the specific inherent stamen or principle in each, the wonderful gradation by which the wines produced excel in quality, flavour, and scent, in fullness, body, and strength; the stupendous coincidence and diversity in the wine itself, and in which they all agree and all differ, must convince us of the wisdom of the arrangement, so similar and dissimilar in its products, each possessing a distinct inherent principle, or *anima vitæ,* that marks the genus, and constitutes the nature and quality of the wines procurable from each respective class of vines: Varied or diversified again by the nature of the soil and climate, of which they more or less partake, and of the culture and manner of treatment in their progress to maturity, being also more or less wholesome as a beverage, cordial, or remedy, according to such treatment.

Assisted and improved by fermentation, which changes their virtue and quality in proportion as they are lighter or fuller attenuated, according to the completion of which, they are rendered sound, pleasant, and sanative; further improved, ripened, and meliorated by age, transportation, firing, fining, and racking; and subsequent bottling, keeping, and cellarage, until they at length arrive in the utmost perfection at the table. Such is the wonderful detail of their progress, from the planting of the vine to the drinkable state of some wines,

wines, in that exquisite degree of perfection to which luxury and refinement has brought them.

Hence the difference in virtue and delicacy of taste in wines, proceed for the most part from the different nature of the grapes from which they are made, the various degrees of maturity, and the nature of the soil where the vineyards are planted; the mode of culture, the diversity in the manner of preparation, and the sundry changes induced on each species of the vine from the temperature of climate. Therefore a knowledge of these essential particulars are indispensable.

We learn from Pliny, that the Romans were very curious in searching after the most excellent wines; the distinction between many of them consisted in the place of their growth, as the Setiranum, the Cacubum, the Falernum, the Gauranum, the Faustianum, the Albanum, the Surrantinum, the Massicum, which were the most delicate wines of Italy in the time of that author.

Among the wines of Greece, they esteemed the Maronean, the Thasian, the Cretan, the Coan, the Chian, the Lesbian, the Icarian, the Syrirean, &c. Their luxurious taste carried them in search of the wines of Asia, as those of Mount Lebanus, and others, as may be seen in the same author.

The ordinary process of making wine is as follows: The saccharine principle of the grape having arrived at perfection, they are then pressed, and the juice flows into a receiver or vessel of suitable capacity, in which the fermentation appears, and proceeds in the following manner:

At the end of several days, and frequently in a few hours, according to the heat of the atmosphere, the nature of the grapes, the quantity of the liquid, and the temperature of the place in which the operation is performed, a movement or intestine motion is produced in the liquor, which continually increases; expansion takes place with the accumulating heat, and the volume of the fluid proportionally increases; it becomes turbid and oily; carbonic acid, or fixed air, is disengaged, which fills all the unoccupied part of the vessel, and the temperature increases from sixty-five to seventy-five degrees of Farenheit's Thermometer, and often higher, with a strong ebullition.

At the end of several days the intestine motion ceases, the heat decreases, the mass falls, the feculencies subside, and the liquor becomes clearer, and is found to be less saccharine, more odorant, of a vinous flavour, and more or less of a red colour, from the re-action of the ardent spirit upon the colouring matter of the skin of the grape, which ardent spirit is produced by the previous fermentation.

The wine is usually taken out of the fermenting vessels at the period when all the phenomena of fermentation have subsided.

When the mass is settled, the wine then assumes its natural colour; when it has become clear, and its heat dissipated, it is put into casks, where, by a second and insensible fermentation, the wine clarifies, its principles combining more perfectly together, and its taste and smell become more and more developed. If this fermentation is stopped or suffocated, the gaseous principles are retained, and the wine is brisker, and more of the nature of Must.

The causes of an imperfect fermentation are the following: I. A deficiency of heat;—in which case the fermentation languishes, the saccharine

saccharine and oily matters are not sufficiently attenuated, or elaborated, and the wine is unctuous and sweet. II. When the saccharine matter is not sufficiently abundant, as happens in rainy seasons; the wine is then weak, and the mucilage, which is predominant, by its decomposition, causes it to become sour. III. When the juices are too watery, in which case Must, concentrated by boiling, is added. IV. When the saccharine principle is not sufficiently abundant;—this effect may be remedied by the addition of sugar. Macquier has proved, that excellent wine may be made of verjuice and sugar; and M. de Bullion has made wine at Belle-james, with the verjuice of his wine-rows and moist sugar.

There have been many disputes to determine, whether grapes should be pressed with the stalks, or without. This depends on the nature of the fruit. When they are highly charged with saccharine and mucilaginous matter, the stalk corrects the insipidity of the wine by its bitter principle; but when, on the contrary, the juice is not too sweet, the stalk renders it drier, and very rough.

The colouring principle of wines is of a resinous nature, and is contained in the skin of the grape; therefore, the fluid is not coloured until the wine is formed; for until then, there is nothing that can dissolve it; and hence it is, that white wine may be made of red grapes, when the juice of the grape is not suffered to stand and ferment on the husks and mark. They are in this case separated from the Must as soon as the juice of the grapes are expressed.

If the Must be evaporated, the colouring principle remains in the residue, and may be extracted by spirit of wine. Old wines lose their colour, a pelicle being precipitated, which either falls to the bottom, or is deposited on the side of the bottle. If wine be exposed to the heat of the sun during the summer, the colouring matter is detached in a pelicle, which falls to the bottom; when the vessel is

 open,

open, the discolouring is more speedy, and is effected in a few days, during the summer. Wine thus deprived of its colour is not perceptibly weakened.

The vinous fermentation has been examined with great accuracy by M. Lavoisier. According to him, the vegetable juice, of which wine is made, consists of oxygen, hydrogen, and carbon, combined with each other in different proportions, so as to form chiefly water and sugar. The fermentation produces a separation of these elements, and a new combination of them: a quantity of oxygen and carbon combine and fly off under the form of carbonic acid gas; a part of the carbon, oxygen, and hydrogen, combines first with each other, and then altogether, to form alkohol; another part forms acetous acid; the water still remains, and a residuum falls to the bottom, composed of the three elements combined in other proportions.

By the result of experiments made to ascertain the quantity of each of the component parts of the different wines, arranged in the following Table, it appears, that the red wines of Marche and Branbourgh contain the most water; Malmsay most spirit; Vino-tinto most unctuous matter; and Spanish the most gummy and saline matter; that this last holds the least water, and the least spirit; Champagne the least tartar; and ordinary Rhenish the least unctuous matter.

When once the principles of wine are separated from one another, no art can reproduce wine by joining them together again; when barely the inflammable spirit is distilled off, the addition of the spirit to the residuum does not restore its vinosity; the residuum itself often suffers a new separation upon this addition, its tartarous parts precipitating.

Here is subjoined a Table of the quantities of ingredients in each wine, of the principal wines in Europe.

TABLE

TABLE.

In a Quart of each of the Wines examined.	Highly rectified Spirit.			Thick, oily, unctuous resinous matter.			Gummy and tartareous matter.			Water.			
	oz.	dr.	gr.	oz.	dr.	gr.	oz.	dr.	gr.	lb.	oz.	dr.	gr.
Aland - - - - -	1	6	0	3	2	0	1	5	0	2	5	3	0
Alicant - - - - -	3	6	0	6	0	20	0	1	40	2	2	6	0
Burgundy - - -	2	2	0	0	4	0	0	1	40	2	9	0	20
Carcassone - - -	2	6	0	0	4	10	0	1	20	2	8	4	30
Champagne - - -	2	5	20	0	6	40	0	1	0	2	8	3	0
French - - - - -	3	0	0	0	6	40	0	1	0	2	8	0	20
Frontignac - - -	3	0	0	3	4	0	0	5	20	2	4	6	30
Vin de Grave - -	2	0	0	0	6	0	0	2	0	2	9	0	0
Hermitage - - -	2	7	0	1	2	0	0	1	40	2	7	5	20
Madeira - - - -	2	3	0	3	2	0	2	0	0	2	4	3	0
Malmsey - - - -	4	0	0	4	3	0	2	3	0	2	1	2	0
Vino de Monte Pulciano	2	6	0	0	3	0	0	2	40	2	8	0	20
Moselle - - - -	2	2	0	0	4	20	0	1	30	2	9	0	10
Muscadine - - -	3	0	0	2	4	0	1	0	0	2	5	4	0
Neufschatel - - -	3	2	0	4	0	0	1	7	0	2	2	7	0
Palm Sec - - - -	2	3	0	2	4	0	4	4	0	2	2	5	0
Pontac - - - - -	2	0	0	0	5	20	0	2	0	2	9	0	40
Old Rhenish - -	2	2	0	1	0	0	0	2	20	2	8	5	40
Rhenish - - - -	2	2	0	0	3	20	0	1	34	2	9	1	6
Salamanca - - -	3	0	0	3	4	0	2	0	0	2	3	4	0
Sherry - - - - -	3	0	0	6	0	0	2	2	0	2	0	6	0
Spanish - - - -	1	2	0	2	4	0	9	4	0	1	10	6	0
Vino Tinto - - -	3	0	0	6	4	0	1	6	0	2	0	6	0
Teneriffe - - - -	2	0	0	2	7	0	1	4	0	2	5	5	0
Tokay - - - - -	2	2	0	4	3	0	5	0	0	2	0	3	0
Tyrol Red Wine	1	4	0	1	2	0	0	4	0	2	8	6	0
Red Wine - - -	1	6	0	0	4	40	0	2	0	2	9	3	20
White Wine - -	2	0	0	0	7	0	0	3	0	2	7	0	0

The principles of which wine consist, are I. water, the basis of all fluids; II. inflammable spirit; III. a fine saline matter, which rises in

in distillation immediately after the spirit; IV. the gross salt tartar, called in commerce argol, which in part separates on standing and adheres to the sides of the cask in solid masses; V. a gummy or mucilaginous substance; and VI. a gross unctuous resinous one.

The colour of wine is frequently artificial; a deep red is almost always the effect of artificial additions, as the red woods, elder-berries, bilberries, &c.

All science, to be understood, ought to consist of the pure and simple expression of facts; and my principal intention being to render this treatise generally useful to the trade, I have endeavoured to lay down every thing in the most plain and intelligible manner. Beauty of stile is not, indeed, to be expected in a work of this nature; therefore, if perspicuity is not wanting, I presume the reader will forgive me, where he meets with passages that might have been expressed in a more elegant manner.

Ultimate success in any science depends upon the solidity of the principles which forms its basis, and upon the method of studying them. By attending to all the principles which are combined or disengaged in the operations of nature and art; and keeping an account of all the circumstances which, more or less, influence the results, we are enabled to deduce simple and natural consequences from the whole of the facts.

There are a great variety of grapes, colourless, yellow, bluish, and red; more or less sweet, and of more or less flavour. The colour, it is remarked, is lodged, not in the juice, but in the skin of the grape; the juice, however, as a menstruum, frequently extracts, and becomes impregnated with it, during its expression from the fruit; and is developed more and more, as it is suffered to stand longer or shorter on the skins and mark, as already observed.

One

One and the same kind of grape proves greatly different in taste and flavour, according to the culture, soil, and climate, and exposure to the sun. In cold countries, the vine, if it grows at all, never ripens its fruit; and even in France and Italy it may be observed, that the grapes produced on the south side of hills are much sweeter than those which are grown on the plains.

In very warm dry seasons, the grapes at the bottom of the hills are best; in warm and moist ones, those at the top; such as grow in the middle are always good. In dry summers the grapes are sweetest; but least juicy: in rainy ones, they abound with juice, which is proportionably weaker and more dilute. Frosts in autumn promote their ripening; but frosts succeeding heavy rains, make them apt to burst, and shed their juice.

In some places the grape is concentrated, or rendered richer, by suffering it to remain on tilt: great part of its aqueous moisture has exhaled, the stem of each cluster being cut half through, when the fruit is ripe, to prevent the afflux of any fresh juice from the plant. The sweet Hungarian and Spanish wines are made from grapes that have thus been half dried.

The juice of the grape is called, before its fermentation, Must. Different sorts of Must is obtained from the same kind of grape, produced in the same vineyard, according to the mode of management. The best is that which issues upon breaking, bruising, or treading the picked fruit: inferior sorts are extracted by forcibly pressing the entire cluster, stalks and all.

Dilute watery Musts are enriched by infusing dried grapes in them, or by inspissating a part of the liquor, and adding this to the rest. By these means strong full-bodied wines are obtainable from the poorest juices; and by similar management, even the better sorts of grape-

wines

wines are imitable by the juices of other fruits, artificially concentrated or heightened by the simple sweetness of sugar.

Wine may be divided, with respect to the fermentation, into three classes. Those of the first do not indeed deserve the name of wines, as having scarcely suffered any degree of fermentation at all, and being very little other than boiled Must. Several of the Italian wines are of this sort, and are called by the general name of Vino Cotto, or boiled Wine.

It is to thin watery juices, extremely prone to ferment, and in which fermentation, when once begun, can scarcely be suppressed till it has run beyond the vinous state, that this process is applied. By boiling, the fermentive quality is restrained, and the liquor becomes richer, and continues fit for drinking for at least a year or two, though it is never so wholesome as the fermented wines.

The effects of Must and Wine upon animal bodies are diametrically different: Must relaxes and liquifies, and if drank immoderately, is apt to produce dangerous fluxes: perfect wine, on the contrary, corroborates and constringes.

The second class comprehends those wines which have undergone fermentation, but not a complete one; of these there are two kinds. The first are the thin sweet wines, which are no other than Must partially fermented, or whose fermentation is checked, while it can be checked, before the sweetness has gone off: these wines can scarcely be kept above a year; such are the Tyrol, some of the Savoy, and several of the Italian.

The second sort is the strong, full-bodied, rich, sweet, wines, which are generally a mixture of fermented and inspissated Must; the latter added to increase the richness of the liquor, and prevent the fermentation

ation running beyond its due limits: these kind of wines greatly heat the constitution, and ought to be very sparingly drank: such as Malmsey, Canary, and some of the Spanish and Hungarian Wines.

The third class belong to those wines which have been completely fermented, and have thrown off their gross matter: These are the most perfect wines, and for common use the most wholesome.

Wines sensibly waste in keeping, how closely soever the cask is stopped, a part transpiring through the pores of the wood; it is not the spirituous, but the watery part that is thus lost, for the remaining wine proves stronger than at first, and the strength continues to increase as the quantity diminishes. In filling up the vessels, for it is necessary they should be kept full, we must be careful not to mix wines of dissimilar qualities. The Hungarian does not well bear any other wine, particularly Rhenish: if the spontaneous diminution of a cask of Hungarian wine is made up with Rhenish, though both keep extremely well by themselves, the mixture presently spoils.

Cool cellars are of primary consequence for the preservation of wines: it is owing wholly to the want of good cellarage and defence from the warmth of the weather, that wines are so apt to fret or run into a new fermentation on the approach of summer.

The goodness and wholesomeness of wines are judged, from their being bright, clear, and sparkling in the glass; of an agreeable reviving smell and taste, leaving, when retained in the mouth some time, a slight sense of astringency; being moderately strong and spirituous, passing freely by urine, exciting appetite, promoting a gentle increase of perspiration in the night, keeping the belly open next day, without being followed by a head-ach, heaviness of the limbs, or other uneasiness. Such a wine, moderately used, is a very valuable cordial. The sweet, rich wines are either new, or very strong and fiery; they heat

the blood much more, and if drank to any degree of excess, their effects continue much longer than those of the thinner wines that contain an equal quantity of spirit. The red wines in general have the greatest astringency, which render them more tonic and corroborating. Wine quickens the circulation, raises the pulse, promotes perspiration, warms the habit, and cheers the spirits.

If we are inclined thoroughly to investigate the Doctrine of Fermentation, we must be guided by no theory; we must attend to Nature herself, and trace her through all her instructive windings; it is hypothetical reasoning, not nature, that misleads mankind in general; he is seldom wrong that resorts to her for instruction; she does not bias with specious or falacious reasoning.

But for further illustration of this matter, let us behold the grape in its first stage of growth. Sour, styptic, and ungrateful to the taste; its early or fibrous parts not having, in the language of the older chemists, received strength or heat enough to draw forth its sulphurous, oily particles, to sheath as it were this crude austerity; when it has received a greater draught of nutritious sap, ascending from the root, as from a fountain, in a constant stream, attracted upwards, rarified, and matured by the solar heat, it increases in magnitude, substance, and flavour, supplied by its bounteous fount of nature, until it is ready to burst with exuberance: during all this time the acid austerity is gradually obtunded, not destroyed, by the exaltation of the oliagenous sulphureous particles, gathering strength with age, and combining with the acid, and, as it were, by its superiority assimilating it to itself, until that combined flavour is produced, that distinguishes it from all other fruits, by a delicacy found only in the grape when ripe. A kind of vegetative fermentation that produces all the variety of asture, sour, and sweet.

Through which stages we shall presently find it as regularly return,

return, when under that operation properly called fermentation. We have already seen, that this sweetness is increased by suffering them to stand when ripe, and by artificial means, as by cutting the stem of each branch half through, or twisting them, and thereby causing a partial interseption of the current of sap, which would otherwise destroy the intention, by over-loading and bursting the fruit, or by impoverishing the juice that was intended to be concentrated; which it effectually does, by the sun's vital heat evaporating the superfluous moisture or phlegm, and leaving the fruit more unctuous, sweet, and balsamic; and with less danger of spoiling, or running into a putrid fermentation, than when cut down from the tree.

But however disposed the juices of the watery and poorer kind of grapes, or even the rich, may be to run into a putrid fermentescence, if not duly guarded against; they never run into a vinous ferment, until expressed from the fruit; in which state they are called Must, which, by breaking the fibres of the vessels, changes the disposition of the parts, and is constantly attended with a fermentation, more or less violent, which produces wine: which is brought about by the acid tartareous salt being set at liberty by the intestine motion, which, laying hold of the oily particles, by its subalcaline quality, particularly rarifies, and partially unites with the oil of the plant, and the more subtile part of the earthy particles, depositing the grosser in two substances, the one in form of lees to the bottom, and the other in tartar to the sides of the containing vessel, leaving the supernatant fluid cleansed and clear, of a spirituous, pungent, subastringent taste, covered or blended with more or less of a soft grateful sweet, in proportion to the richness of the fruit, the additions made use of, and the management of the fermentation: by which it appears, that the spirituous parts of the grape are not visible, or rather do not exist, until a resolution and subsequent combination of its parts are brought about by fermentation.

For Must is a sweet liquor, that neither sends spirits to the head to intoxicate, though drank ever so freely, nor affords the least vestage of any when committed to distillation.

The wines of northern climates are generally of a weak body, more acid, and of a sharp taste. To their acidity is owing the laxative virtue they possess. It has been thought, that they tend to produce the stone in the kidneys; but this is entirely conjecture, and has no foundation in experience. The qualities of these wines depend chiefly on their weakness and acidity; and from these qualities their virtues may be understood; of these kind are the Moselle, Rhenish, Claret, &c.

The southern wines are strong, sweet, and unctuous: the Hungarian wines, of which Tokay is one, are supposed the best at present; the Canaries, though more southern, do not afford wines so rich; the reason seems to be, that, being insular, the grape is exposed to the cooling breezes of the sea; Madeira wine is the growth of a warm climate, but from an accidental taste that prevails at present, a particular management of it has been introduced; in Madeira there are mountains, upon which they can grow wines as weak as those of the northern climates; these, however, though grateful, are dangerous. The Italian wines, as southern, should be strong; but from being checked in the fermentation, are sweet and weak; they come over to us in flasks covered with oil, and cannot be kept above a year. The Spanish and Portugal wines cannot be transported to us without brandy, and are the most inflammatory, and least exhilarating we employ, according to the older chemists.

The French wines are certainly, and with justice, preferred to the rest. They may be considered as northern wines, and the best of them are produced in northern provinces, the Burgundy and Champaign. The French wines have heat enough to give them strength. Champaign is in active fermentation, and not so safe as the mellow Burgundy;

Burgundy; but this formerly, from being imported in flasks, was never properly mellowed, and was very heady; this practice is now prohibited, and we have a wine less delicate, but more safe, particularly to the nerves. Claret, as weak and acerb, and transported without brandy, is safe in every respect.

Sweetness in wines depends on the natural richness of the grape, and its maturity; but much more commonly it is the effect of imperfect fermentation, from racking off the vinous liquor from the lees, as soon as the fermentation is tolerably active, into new vessels successively, till once it be checked and a sweetness remain. Such are the Spanish and Italian wines. Sweetness also may arise from the vintners mixing with sharp wines a quantity of unfermented Must.

Sharp wines have that property from different causes: first, from the nature of the grape, to be judged of according to the climate; thus the wines of the northern countries possess this property more than the southern, if we except Teneriffe, which possesses a sanative sharpness to an eminent degree.—Secondly, sharpness, whatever be the state of the grape, arises from having undergone a very active fermentation, as in Hock.—Thirdly, sharpness may proceed from wines long kept, and partly converted into vinegar: in one case then sharpness is a symptom of weak wine, and therefore of a cooling and less inflammatory liquor; in healthy stomachs these may be more freely indulged, and promote the digestion of animal food; but, when the sharpness proceeds from unfinished active fermentation, these wines may be hurtful, as too cooling, and as debilitating to the stomach; flatness in wines may depend on want of a proper degree of fermentation; it may proceed from too great ripeness, or mellowness, and the wine increasing in age; thus, wine kept long in well-corked bottles, not having a necessary quantity of air, turns vapid.

When artificial means are used to prevent fermentation, it will

induce

induce flatness, as brandy mixed with wines; hence the flatness of Spanish and Portugal wines, in comparison of French. Briskness in wines proceeds from being in a state of active fermentation, and always implies more or less of a crude state; whence, though more agreeable, it is the more dangerous. A distinction of wines is made into those which are apt to affect the nerves and head, and those which produce fevers. Champaign, from using it flowering in the cup, is very apt to intoxicate.

Experienced drinkers have a rule for this, rejecting such Champaign as retains its flowering long in the cup. The strength or weakness of wines, are compatible with their other qualities. All wines are in some degree heating and inflammatory. Smoothness in wines depends on their sweetness and mellowness, except it is mistaken for flatness.

Roughness depends, First, on the natural acidity and want of sugar in the juice. Secondly, on the unripe state of the juice; at first the fruit is of a hard celular texture, which is filled first in the middle with a fluid, which gradually extends over the fruit, so that within the centre is always ripest; hence the difference between the juice spontaneously flowing from the grapes laid one above another, and from that which is expressed; for every expression gives acerbity.—Thirdly, roughness may depend on artificial means, as the addition of sloes, &c. Fourthly, on the addition of the husks to the Must in fermentation.

It is proper to observe, that though, after the liquor has become vinous, and a partial cessation of the more obvious phenomena takes place yet the wine still suffers a slow and imperceptible fermentation. We are not then to consider the liquor in a quiescent state; but as constantly approaching to the next stage, which we are now to consider, viz. the acetous fermentation

This

This kind of insensible fermentation, or what we may call the intermediate change, seems to be necessary to the perfection of the wine. Its degree, however, is to be regulated under certain limitation; when too much checked, as by cold, thunder, or such like causes, the wine becomes vapid; when too much encouraged by heat, contact of air, &c. it approaches too far to the acetous change; but in order that the vinous should fully proceed to the acetous fermentation, several circumstances are required; and these are in general the same that were before necessary to the vinous stage.

These conditions are, a temperate degree of heat, a quantity of unfermented mucilage, an acid matter, such as tartar, and the free access of external air. When thus situated, the liquor soon passes into the acetous fermentation; but during this stage the phenomena are not so remarkable as in the vinous; the intestine motion is now less considerable, (except where new rape is used) a gross unctuous matter now separates to the bottom, the liquor loses its vinous taste and flavour, it becomes sour, and on distillation affords no inflammable spirit.

It is now the acetous acid, or vinegar; and when separated by distillation from the unctuous lees, may be preserved a considerable length of time, without undergoing the putrid change; to this last, however, it always approaches, more or less, in the same way that the vinous always verges to the acetous fermentation; and this will much more readily happen if the acid be allowed to remain with the unctuous feculent matter, above mentioned.

When thus situated, the vinegar quickly loses its transparency, assumes a blackish colour, loses its sourness and agreeable odour, has now an offensive taste and smell, and when distilled, at a certain period of the process, it yields volatile alkali.

From

From the preceding phenomena it is obvious, that the same substances which are capable of the vinous and acetous, are also capable of the putrefactive fermentation. It is, perhaps, impossible to induce the first without a mixture of the second, or the second without a mixture of the third. Hence it is, that every wine is a little acid; and that there are few vinegars without some disposition towards putrefaction.

All vegetables have more or less tendency to putrefaction; and a great number are capable of the acetous fermentation; but the proportion capable of the vinous is not so considerable; and these last will run into the putrid in circumstances in which they cannot undergo the vinous, or even the acetous fermentation.

Thus flour made into a soft paste will become sour; but must be perfectly dissolved in water to make it fit for the vinous stage, whereas mere dampness is sufficient to make it pass to the putrid fermentation.

It should be further observed, that though every vegetable that has suffered the vinous, will proceed to the acetous and putrefactive fermentation, yet the second stage is not necessarily preceded by the first, nor the third by the second; or, in other words, the acetous fermentation is not necessarily confined to those substances that have undergone the vinous, nor the putrefactive to those that have undergone the acetous fermentation.

Thus it is, that gum dissolved in water shall pass to the acetous, without undergoing the vinous fermentation. Glutinous matter seems to run into putrefaction without shewing any previous acescence; and further, these changes frequently happen, though the matter be under those conditions favourable to the preceding stages.

Acids,

Acids, or acid liquors, though they thicken pure oils, or render them consistent, do not impede the dissolution of gum. Alkaline salts on the contrary, both fixed and volatile, though they render pure oils dissoluble in water, prevent the solution of gum, or of mixtures of gum and oil.

If any pure gum is dissolved in water, the addition of an alkali will occasion the gum to separate and fall to the bottom in a consistent form; and if any oil or resinous body was previously blended with the gum, it either sinks to the bottom, or rises to the top, according to its gravity.

Collectively, the juice or Must is composed almost entirely of five ingredients; namely, water, sugar, jelly, gluten, and tartaric acid, partly saturated with potass; the quantity of sugar which grapes fully ripe contain is very considerable; it may be obtained in crystals by evaporating Must to the consistence of syrup, separating the tartar which precipitates during the evaporation, and then setting the Must aside for some months, the crystals of sugar are gradually formed *. From a French pint of Must, the Marquis de Bullion extracted half an ounce (French) of sugar, and 1-16th of an ounce of tartar. According to Proust, the Muscadine grapes contain about thirty per cent. of a peculiar species of sugar.

When Must is put into the temperature of about seventy degrees, the different ingredients begin to act upon each other, and what is called vinous fermentation commences; the phenomena of this fermentation are an intestine motion in the liquid; it becomes thick and muddy, its temperature increases, and carbonic acid gas is evolved. In a few days the fermentation ceases, the thick part subsides to the bottom, or rises to the surface, the liquid becomes clear, it has lost its

* Bullion, Jour. de Phys. xxix. 3.

its saccharine taste, and assumed a new one; its specific gravity is diminished; and, in short, it has become the liquid well known under the name of Wine.

Now, what is the cause of this fermentation? what are the substances which mutually decompose each other? and what is the nature of the new substance formed?

These changes are produced altogether by the mutual action and re-action of substances contained in Must; for they take place equally well in close vessels, and wine is formed equally good as in the open air.

If the Must be evaporated to the consistency of a thick syrup, or to a rob, as the ancient chemists termed it, the fermentation will not commence, though the proper temperature, and every thing else necessary to produce fermentation be present; but if this syrup be again diluted with water, and placed in favourable circumstances, it will ferment; therefore, the presence of water is absolutely necessary for the existence of vinous fermentation. But, on the other hand, if the Must be too much diluted with water, it either refuses to ferment altogether, or its fermentation proceeds very languidly.

If the juice of those fruits which contain but little sugar, as currants, be put into a favourable situation, fermentation indeed takes place, but so slowly, that the product is not wine but vinegar; but if a sufficient quantity of sugar be added to these very juices, wine is readily procured.

No substance whatever can be made to undergo vinous fermentation, and to produce wine, unless sugar be present; sugar, therefore, is absolutely necessary for the existence of vinous fermentation; and we are certain that it is decomposed during the process; for no sugar can be obtained from properly fermented wine. It has been sufficiently

ently demonstrated by the experiments of Macquer, and the observations of Chaptal, that the strength of the wine is always proportional to the quantity of sugar contained in the Must. From the experiments of Buillon we learn, that when Must contains little sugar, the fermentation is rapid; but the product yields little alcohol. When the proportion of sugar is great, the fermentation is slow; but the product yields much alcohol.

All those juices of fruits which undergo the vinous fermentation, either with or without the addition of sugar, contain an acid. The Marquis de Buillon has ascertained that Must will not ferment if the tartar which it contains be separated from it; but it ferments perfectly well on restoring that salt. The same chemist ascertained, that the strength of wine is considerably increased by adding tartar and sugar to the Must. We may conclude from these facts, that the presence of a vegetable acid is necessary for the commencement of the vinous fermentation. It deserves attention, that Buillon obtained more tartar from verjuice than from wine; and he observed, that the more the proportion of sugar increased in grapes, the more that of tartar diminished.

All the juices of fruits which undergo the vinous fermentation contain an extractive matter, composed of what Deyeux has called the sweet principle. This substance has not been examined with much precision; but it seems to consist of mucilage, gluten, and extract. Now the presence of this substance is also necessary for the commencement of fermentation; for sugar, though diluted with water and mixed with a vegetable acid, refuses to ferment, unless some mucilaginous matter be added. Buillon found, that sugar, tartar, and water, did not ferment; but on adding vine leaves, the fermentation became rapid. And Bergman found, that sugar dissolved in four times its weight of water, and mixed with yeast, undergoes the vinous fermentation; and the experiment has been often repeated since; in

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both these cases the ferment appears to be gluten ;—thus we see, that for the production of wine, a certain temperature, a certain portion of water, sugar, a vegetable acid, and gluten are necessary. Mr. Lavoisier found, that sugar would not ferment unless dissolved in at least four times its weight of water; this seems to indicate, that the particles of sugar must be removed to a certain distance from each other before the other ingredients can decompose them.

When all these substances exist in Must, in proper proportions, the fermentation commences very speedily, provided the liquid be placed in a proper temperature; and its rapidity (other things remaining the same) is always proportioned to the quantity of liquid exposed at once to fermentation. The heat evolved is always proportioned to the rapidity of the process, and indeed may be looked upon as the great cause of that rapidity; according to Chaptal, the temperature during fermentation is never lower than sixty degrees, and sometimes it is as high as ninety-five.

During the fermentation, the quantity of sugar is constantly diminishing; and when the process is completed, the whole of the sugar is decomposed; the liquid has become more fluid, specifically lighter, and has acquired a vinous taste, owing most probably to the formation of alcohol. Whether the other substances which constitute a part of the Must have undergone any change, or whether they have merely contributed to the decomposition of the sugar, is not precisely known. The experiments of Lavoisier, to whom we are indebted for the first precise explanation of fermentation, render the second supposition most probable. From these experiments, it follows, that the sugar is divided into two portions; one portion separates in the form of carbonic acid, and the other, containing a great excess of hydrogen, remains under the form of alcohol. This alcohol is combined with colouring matter, and with the acids of the wine, so intimately, that it can only be separated by distillation. The carbonic acid carries along with it a certain

certain portion of alcohol, as was pointed out some time ago by Chaptal. The extractive matter separates, either precipitating to the bottom, or swimming on the surface.

It seems to be more than probable, from the experiments of Buillon and Chaptal, that the tartaric acid is partly decomposed during the fermentation, and that a portion of malic acid is formed. The process, therefore, is more complicated than was suspected by Lavoisier. It is obviously analogous to combustion, as is evident from the evolution of caloric and the formation of carbonic acid, which is a product of combustion. Proust has ascertained that, during the fermentation, not only carbonic acid, but azotic gas also, is disengaged; this is a demonstration, that all the constituents of Must are concerned; for sugar does not contain that principle.

After the fermentation has ceased, the liquor is put into casks, where the remainder of the sugar is decomposed by a slow fermentation; after which, the wine decanted off from the extractive matter, is put into bottles.

The properties of wine differ very much from each other, according to the nature of the grapes from which the Must was extracted, and according to the manner in which the process was conducted. These differences are too well known to require a particular description; but all wines contain less or more of the following ingredients; not to mention water, which constitutes a very great proportion of every wine.

I. An acid:—All wines give a red colour to paper stained with turnsole, and of course contain an acid. Chaptal has ascertained, that the acid found in greatest abundance in wine is malic acid; but he found traces also of citric, and it is probable that wine is never destitute of tartar. All wines which have the property of frothing when

when poured into a glass, contain also carbonic acid, to which they owe their briskness; this is the case with Champaign. These wines are usually weak, their fermentation proceeds slowly, and they are put up in close vessels before it be over. Hence they retain the last portions of carbonic acid that have been evolved.

II. Alcohol:—All wine contains less or more of this principle, to which it is indebted for its strength; but in what particular state of combination it exists in wine cannot easily be ascertained. It is undoubtedly intimately combined with the other component parts of wine; as Fabroni has shewn that it cannot be separated by saturating the wine with dry carbonat of potass, though a very small portion of alcohol, added on purpose to wine, may be easily separated by means of that salt. But as alcohol separates along with the carbonic acid during the fermentation, we can scarcely doubt that it has been formed. When wine is distilled, the alcohol readily separates; the distillation is usually continued as long as the liquid which comes over is inflammable; the quantity obtained varies according to the wine, from a fourth to a fourteenth part of the wine distilled; the spirit thus obtained is well known under the name of Brandy. Buillon has observed, that when wine is distilled new it yields more alcohol than if it be allowed to get old. What remains after this distillation is distinguished in France by the name of Vinaose; it consists of tartar, &c. and when evaporated to dryness, and subjected to combustion, yields potass.

III. Extractive matter:—This matter exists in all wines; but its proportion diminishes according to the age of the wine, as it gradually precipitates to the bottom.

IV. Every wine is distinguished by a peculiar flavour and odour, which probably depends upon the presence of volatile oil, in so small a quantity that it cannot be separated.

V. The

V. The colouring matter of wine as beforementioned, is originally contained in the husk of the grape, and is not dissolved till the alcohol is developed. This matter is analogous to the other colouring matters of plants; a set of bodies possessed of remarkable properties, but too little examined hitherto to be introduced with much advantage here. This colouring matter, we have seen, precipitates when the wine is exposed to the heat of the sun; it sometimes also precipitates in old wine, and it may be easily separated by pouring lime-water into wine, or adding lime in substance.

The principal wines drank in Europe are as follows: (1.) Madeira Seck, (corruptly written Sack) which signifies dry; the produce of the Madeira Islands; Palma, one of the Canary Islands, affords another Sec, called Canary, or Palm Sec; these wines are so called from being produced from half-dried grapes. There is another sort of Sec wine inferior to both the foregoing, prepared about Xeres, in Spain, and hence called, according to our orthography, Sherries, or Sherry. (2.) The wines of Candia and Greece, particularly the latter, are of common use in Italy. Malmsey was formerly the produce of these parts only, but is now brought chiefly from Spain; it is a sweet wine, of a golden or brownish yellow colour; the Italians call it *Mana alla Bocca e Balsamo al Cervello,* "Manna to the Mouth, and Balsam to the Brain."

Zant and Cephalonia send also to Venice some good, and no small quantity of bad or indifferent, wines; almost all the wines, indeed, made use of in the Venetian territories come from Greece and the Morea, of which there are some sorts so bad and so cheap, that large quantities are made into vinegar, for the preparation of cerusse. (3.) Italy, not Greece, produces the Vino Greco; this is a gold-coloured unctuous wine, of a pungent sweetness, the growth of

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Mount Vesuvius, greatly sophisticated by the Neapolitans. In the neighbourhood of Vesuvius, is made the Manguiguerra wine, as also a thick, blackish one, called Verracia; and at the foot of the hill, the delicious Vino Vergine; the Italians apply this name to other wines made without pressure.

The kingdom of Naples affords the Campaniæ, or Pausilippo, and Muscatel, the Surentine, the Salernitan, and other excellent wines; as also the Chierello, much drank at Rome; but the principal of all these wines is the red, fat, sweet, and gratefully poignant one, called Lachryma Christi. The Ecclesiastical State produces the light, pleasant Albano; and the sweet Montefiascone, a yellowish, not very strong wine, which comes the nearest to good Florence, but does not keep well: together with several of less note, as the Nomentan, Monteran, Velitrin, Prentic, Il Remancsca d' Orireto, &c.

(5.) In Tuscany are the excellent white and red Florence, the celebrated hot, strong, red wine de Monte Pulcina, the Montalneo, Porti Hercole, &c.; but along the coast of the Adriatic, at Ancona, Rimini, Pesaro, as far as Bologna, I met with exceeding bad wines, chiefly of the boiled, unfermented kind, heavy, disagreeable, and unwholesome.

(6.) In Lombardy also there is abundance of bad wines: the Modenese and Montserrat are tolerable; the Mareemino, produced about Vicenza and Padua, pretty good. The other wines most commonly drank in that province, are the Brescian, Veronese, Palacentine, Lumelline, and Pucine; and in the Genoese, the Vino Dimonti Vernacia, Vino Amabile, or Vino Dicinque, Terra et Vino Razzese; between Nizza and Savona is produced an incomparable Muscadine; near Aguilcia is the Roseta; and near Pavia the Vino Piccanti. (7.) Piedmont and part of Savoy have excellent wines. (8.) The Sicilian, Sardinian, and Corsican wines are also good; the first, as particularly

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the Catanian, Panarmitan, Messinian, and Syracusian, are accounted the best, and are chiefly bought up by the Knights of Malta. (9.) There are a few of the Spanish kind in Germany, as the Alicant, (which is a thick, strong, very sweet, and almost nauseous wine) Sherry, Spanish, Malmsey, Rhenish, and that simply called Spanish wine. But in Spain itself there are many more; Tarragon, Salamanca, Malaga, Cordova, Galicia, Andalusia, and bastards, as Vino de Terro, &c. Many of the Spanish wines are composed of half fermented wine, mixed with inspissited Must variously prepared; or of an infusion of dry grapes in weak Must. No wines freeze more difficultly than the Spanish, they abounding both with unctuous matter and inflammable spirit. (10.) In Portugal there is plenty of red Port; a cheap, but not a very excellent wine, drank in large quantities in England. Such was the language of Gaspar Numann, in 1733. The best Vino Tinto, a blackish red wine, used by the coopers for colouring other wines, is said by some to be the produce of Portugal.

This kingdom deals largely in Madeira, of which the king receives yearly 12,000 pipes, by way of tithes.

(11.) In France there is a great variety of wines; of which the strong, sweet, full bodied, spirituous ones are called Vins de Liqueur. There is scarcely a province in France that does not produce wine: Languedock and Provence afford the sweetest; and the same province with Champaign and Burgundy, the strongest: the wines of the northern parts, as Picardy and Guinne, are the worst, except the Claret of the latter; those about the middle of the kingdom, as Bourdeaux, Paris, and Orleans, are of a middling kind.

The most celebrated of the French wines are Champaigne, Burgundy, Vin de Beaum, or Partridge Eye, Cote Rotie, St. Lawrence,

 Frontiniac,

Frontiniac, Muscat de Leon, Cahors, Hermitage, Grave, Vin de Haye, Claret, &c. (12.) In Switzerland, the best are Neufchatel, Velteline, Lacote and Reeiff Wine. The Velteline Straw-wine, so called from the grapes being laid on straw before they are pressed, is particularly celebrated. (13.) The dry grape wines of the Upper Hungary are in general excellent, and greatly superior to those of the Lower; they have a delicious aromatic smell and taste, a notably diaphoretic and corroborating virtue, and when drank freely occasion no head-ach, heaviness of the limbs, or other inconveniencies; they do not become easily wine-wed even in open vessels, and retain their sweetness and agreeableness for a length of time, though they lose a little from year to year.

(14.) Among the German wines, the Tyrol are very delicate, particularly those of Tramin and Etsch, but they do not keep. (15.) Good Austrian wine is not to be rejected; those of Kloster-Neuburg and Brosenburg are accounted the best, and seemed to me to excel in taste that of Edenbourg, in Lower Hungary. There are also good wines in several other parts of the Imperial dominions. (16.) In the Palatinate, the best wine is that of Worms, especially the sort called Woman's Milk; and next to them is those of Edenhof and Ambach. (17.) Among the more esteemed German wines are to be reckoned also Rhenish, Mayne, Moselle, Neckar, and Elsass; a certain writer calls the Rhenish made in Hockhiem (Hock), the prince of wines in Germany. (18.) The Bohemian, Silesian, Turingian, Messnian, Naumberg, Brandenburg, and other German wines, are greatly inferior to the foregoing; some, however, of those of Mesnia and Marche, made from ripe, picked grapes, have this advantage, that they are greatly meliorated by age, so as to be preferred by many to Rhenish, Neckar, and Franconia Wines, and frequently mixed with others of greater note. The tartish German wines keep the longest of any; some of them have kept for two or three hundred years;

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and in Strasburg there is a cask fourteen hundred years old, and many above seventy, the wine being occasionally racked off into smaller casks, that the vessel may be constantly full. These very old wines are preserved rather for curiosity than use, as they not only grow too strong for drinking, but at last quite disagreeable; the best are those of a middle age, from twenty to fifty.

Among the wines of Germany, the exceeding luscious, full-bodied, delicate flavoured, Tokay, of Hungary, should not be omitted, of which some reckon four sorts; three of them are called the Tokay of Commerce, and presumed to be of different degrees of quality, none of which are equal to the Tokay of Mount Luct Schau, prepared from the delicious, small, round grapes, that come to greater perfection than any of the others on this hill, from its southern aspect, and peculiar management of the fruit. The whole of this wine is reserved for the use of the Imperial Family. *See Ashmen Hausen.*

PORTUGAL WINES.

MADEIRA,

An excellent wine, the produce of an island of that name in the Atlantic Ocean, belonging to Portugal, is made from a variety of dry grapes, among which are the Verdello, Listan, Vidonia, Negramullo, Tintillo, Gual, Malvoise, Musquee, &c.

In the culture, pressing, fermentation and making-up of which the planters and merchants are very attentive, and have been more particularly so of late years, since the inhabitants of a neighbouring island (Teneriffe) have so considerably improved the wines of their island.

In 1728, Dr. Halley computed the produce at about 40,000 pipes, which were chiefly sent to the British Colonies in America, the consumption in these kingdoms at the time, being comparatively small to what it is at present in Madeira wines.

The genuine, or best sort, is naturally of the colour of oil, and tinges the glass with a light bluish hue, on which it hangs in proportion to its richness. It has a kernelly taste, somewhat of the wallnut flavour. The juice is concentrated or enriched by the grapes being suffered to stand on the vines untill they wrinkle and put on the appearance of half-dried raisins.

The commoner sort is made of the ordinary grapes, and they tinge it in the wine-press with the vina-roxa, or red grape, cultivated on the island for the purpose, which gives a deep foxy redness to the wine. Mr. M'Bride, in 1793, in an extract from a letter of a native of the island, observes, "The island is no more than forty leagues in circumference, being divided into thirty-two parishes, properly speaking with regard to wines, twenty-seven are situated on the south side; seven of which produce, for the greatest part, a very fine wine indeed; five good enough; six middle ones; seven inferior; and two very bad or none. The north-side contains five parishes; one produces wine adapted to every composition, or imitation, but pure, and is indifferent: the other four, their wines are so bad, that they are only fit for distilling; but, as they are exceedingly cheap, ambition very often prevails upon honesty; and this, as others, are counterfeited, prepared, and mixed in such a manner, that they find customers, and go abroad." Thus far my author.

When I was on the island last, that is about four years before the period Mr. M'Bride speaks of, (1789) there were, as there are in other wine-countries, good, bad, and indifferent wines; independent of the changes induced from alteration of season, common to them all; but none of the sofistications, or abuses, alluded to, fell within my observation, though I have been a pretty close observer, both in this and other wine-countries, as I should hope this treatise will demonstrate.

The same author goes on with his extract of a letter, &c. "All the produce of this island in wines I may compute to be 60,000 pipes, whereof 14,000 are exported yearly. The quality of these wines are divided into five classes: 1. West Indies. 2. Philadelphia. 3. New York 4. London. 5. Particular: these two last qualities being the best." He further goes on, saying, "I do here assert, that the island never produced above 1000 pipes, which may come under the description of good; without adulteration, preparation, or imitation.

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All these tricks are made by the planters themselves, and more by the merchants. The same thing happens exactly with Lisbon, Oporto, St. Ubes, and Calcavello wines; and in Spain, with Xeres, Malaga, St. Lucar, Tintilla of Rota, &c. &c. Rota, a little town opposite Cadiz, in Spain, never after the creation of the world has produced above 50 pipes of true Tintilla, and, for all that, more than 1000 are exported every year."

Every man, capable of observation, who has visited the wine countries in or out of Europe, and who have had similar opportunities to those I have had, must know, that the planters and merchants necessarily unite in giving the wines of their respective countries that flavour and complexion which renders them acceptable to the home or foreign markets, at which they are vended; and which, at some of the wine countries of Europe, are not made the least secret of: the flavouring and colouring ingredients of which being thrown out at the door, when the colour is extracted and the desired flavour obtained.

So far are they from considering it as an abuse; nor should it be viewed in that light, any more than we should condemn the distiller most expert in making the richest compound cordials; the ingredients of which he compounds them, and to which they owe their excellence, he frequently is as little cautious of exhibiting at his door, as the planters and wine-merchants we have been speaking of.

As a chemist and physician I vouch, that it is not the practice in Madeira or Teneriffe, to use an insalubrious ingredient in the making-up their wines, for had any thing of the sort come to my knowledge, I would be the first to expose it. The salubrity of these wines, and their sanative effects on the moderate, or the liberal use of them, are unquestionable; and their medicinal efficacy with arthritics and other invalids, together with their inestimable use to our mariners in warm latitudes, are too well established to admit a doubt on the validity of this

this assertion. With respect to the Sherry and the other wines he enumerates, I can, with the strictest truth, allege the same.

That the thin wines are blended with the rich and full-bodied, to bring them to the market standard, and the latter applied to make up the former for sale, is undoubtably true; and for the reasons before-mentioned, must ever be the case, as any one acquainted with wines, or that has given the subject a thought, must readily allow.

The planting, culture, and growth of the vine is very particularly attended to by those who undertake the management of a vineyard on this island. The wines are mostly planted on the side of a hill of a south or southern aspect, or on inclined plains, at or near the foot of such hills; sometimes from cuttings, but mostly from layers, which is much the best mode of propagating this plant. The manner of preparing the ground differs something, according to the situation of it, being performed one way on mountains, another when on more moderate hills, and differently in some respects when on inclined plains, or small aclivities, and plain or level land.

On some estates they erect little walls, breast high, of dry stone dug out of the trenches, in which the vines are planted in rows from east to west; these walls, trenches, and vine-rows, ranged at proper distances, resemble a regular, magnificent stair-case, and have a charming effect. These walls answer several purposes; in the first place, by upholding the earth they hinder the roots of the vines from being laid bare; secondly, they withhold the rain-water, which would otherwise run down the hills without soaking into the earth; thirdly, they defend the blossoms and fruit from the violence of the winds; fourthly, they increase the reflection of the sun-beams, causing a greater heat to accumulate on the vine; fifthly, they occasionally admit of poles, of a proportional length, being suspended from

wall

wall to wall, either to cover, defend, or support, the fruit, as occasion may require.

The principal stakes or props, to which they bind each vine, are strong, and usually appear about three or four feet above the surface of the ground; the smaller ones, to which they attach the younger shoots, are more slender; the wild cane is mostly employed for this last purpose, and for laying from stake to stake, to suspend the fruit for its better exposure to the sun and its reflected heat from the soil; to increase their strength for the support of the fruit approximating to its full growth, they are generally crossed at right angles with canes of the same sort, so as to form the whole into a square lattice-work, which, to look down from above, gives a pleasing picturesque appearance, and forwards the ripening of the suspended clusters to any assignable degree of richness, proportioned to the length of time exposed.

The season for beginning the vintage varies, mostly depending upon the weather during the preceding spring and summer, which makes it sooner or later by fifteen or twenty days, and is usually about the latter end of September or beginning of October. The grapes being of a due ripeness, and the weather suitable, they are carefully gathered and brought to the press; (which shall be hereafter described) they are pressed together, without being separated from the stem, or footstalk; the juice or Must is allowed to ferment for some days, during which the jessio, by the islanders pronounced yesso, is added in fine powder; it assists fermentation, corrects redundant acidity, and occasions a slight degree of bitterness.

The liquor is then drawn off into pipes, in which it finishes its fermentation. After three or four months, the clear wine is racked from the lees it has deposited in those casks; when a suitable quantity of French Brandy is added. After a few rackings it is set aside to

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improve by age. On exportation there is sometimes a small portion of the same sort of brandy added to fit it for the voyage, in proportion to the length of which, and the heat of the climate, it ripens, meliorates, and becomes more grateful to the palate.

This amelioration is procurable to some extent, by firing and rolling on the island, in which they imitate the French and Germans: the coldness of the northern parts of these countries that produce grapes, first suggested this mode of bringing wines forward, or of giving apparent age and real ripeness; it was afterwards resorted to in the more southern, when cold summers, and bleak winds had prevented the fruit from duly becoming ripe on the tree. About twenty-five years ago I suggested it at Madeira. I have since learned it had been privately practised, that is, in 1790: however this may be, the expediency, in my opinion, is incontrovertible.

The Brandy prepared from the small wines and lees of the other wines is not, as I was informed, either very good, nor their Vinegar in any great abundance; and none, that ever I heard of, could be said to be a regularly-prepared vinegar, suited to any commercial purpose.

The inferior wines consumed in the island are made up with their own ardent spirit. It is singular, that French Brandy should be prohibited as an article of importation, without which their particular and best wines could not be made up: however, this absurd law is evaded, by landing the Brandy under the name of Frankie, that is, to be re-exported, which, I understand, is very rarely the case. This observation is not made to shew that Spain is more remarkable for its legislative blunders than their neighbours; for instance, see the article Hops, in Book the First, under the head Brewing, page 5.

As the caprice of fashion has reigned in England of late years in respect to wines, as well as other articles of luxury, sometimes they

 require

require them of one colour, and at other times of another; at present they are getting more and more into quite pale white wines. Yesso, as before observed, added during the fermentation, gives the wine that binding quality and sensation to the stomach, for which it is so eminently esteemed, and which renders it so agreeable a stomatic.

Madeira that has not been fired, or undergone a voyage to warmer latitudes than the place of its growth, does not well bear the climate of these kingdoms; and it becomes better the more it is conveyed to the south, or the warmer it is kept. The expedient sometimes used here, of putting it into our stoves or hot-houses, is very advantageous in bringing forward and ripening the wine.

RED PORT,

PRINCIPALLY the growth of *Oporto, Viana, Figuera,* &c. The greatest quantity of these wines are the produce of the provinces of Tran as Montes, or Transmontana and Entre Minho el Duoro; that is to say, the whole country on the river Duoro, as well as the plain country between the Duoro and the Minho, as the country on the Duoro beyond or over the mountains.

OPORTO is a large and populous city, and, as Dr. Halley informed us, in 1728 contained about 30,000 inhabitants. It stands on the north bank of the great river Duoro, in the province of that name; the walls

walls of the town come close to the river; and, when the freshes or land floods come down the river, the stream is very violent; in which case the ships are obliged to warp in close to the walls, and carry out-fasts on shore, as no anchors can hold them in the stream. The Bar of the harbour is very dangerous, and the river is deep. When the sea runs high there is no venturing in;—then the ships bound to this port go away to Villa de Conda, and sometimes to *Viana,* until the weather abates.

Viana, a small but very populous city, stands on the north shore of the River Lima, about a league from the sea, and has a very good and safe harbour. The town is pleasant, clean, and handsomely built. It is a place of great trade; and the country, for some leagues on both sides of the river, is well planted with vines, which yield a very good sort of wine, not quite so full and bright as *Oporto,* or so strong and full-bodied as at Lisbon, but such as are well accepted of in England.

Figuera, a small port, in or near the Bay of Lagos, in the fertile province of *Algarva*; famed for the quantity and quality of the figs produced there, and shipped from *Figuera.* It has been for some years coming into repute for its wine,—a good sort of Red Port, which takes its name from the port it is shipped at.

These wines are usually shipped at the several ports above-mentioned; and are well known in these kingdoms; they are chiefly red, of a deep, bright colour, and very strong. Comparatively, they were but little known in former times, and seldom imported in quantity, but on the failure of the Florence and French vintages. When the vintages failed in France, and the wines there proved poor and thin, they were used to mend the body and colour of the French Wines; and for these occasions, our annual imports of them did not often exceed 2000 pipes. But if the vintage in France proved good, and the French Wines held their colour, the Portugal Wines were not

 esteemed

esteemed here; as a proof of this, 500 pipes would glut the market before the wars with France in the reigns of King William and Queen Anne, when the duties laid on the French Wines amounted nearly to a prohibition. In Thomas Langham's Book of Rates, published in 1717, when *Florence* and other *Italian* and *Levant* Wines, was rated only at 25*l.* 3*s.* 9¼*d.* per ton, entered in the port of London; and Southampton Port, entered at the ports of Bristol and Southampton, the same: *French* Wines were rated in the port of London at 56*l.* 5*s.* per ton; while the rate of *Portugal* Wines at the same port was only 27*l.* 5*s.* 3*d.* 1-7th; and *Spanish* Wines but 28*l.* 3*s.* 9½*d.* per ton.

Or, as Doctor Halley has it, "The wine business taking a new turn in England, and the French trade suffering for some years a general prohibition during the war, and afterwards, the French Wines being loaded with a duty of fifty-two pounds per ton, which was almost equal to a total prohibition; and the Portugal Wines being admitted here at less than half that rate, their trade took a sudden rise, and Spain came in for a great share, by sending us large quantities of wine from Galicia, Alicant, Malaga, Barcelona, Bene-Carlo, and other places; and Italy also, from Leghorn and Florence; yet nothing could interrupt the trade from *Oporto,* where the encouragement was so great, that the Portuguese, never till then known to be so diligent in business, prompted by the sweets of the profit, have so increased thier vineyards upon the banks of the *Duoro,* that almost all the country for thirty or forty leagues up, and on both sides of the river, is covered with vines, and the numbers of people so increased, by their flocking to these new plantations for employment, that the whole country on that side seems to have a new face, being apparently not only enriched, but even new peopled by the increase of the wine trade."

"As this relates only to the vineyards in this part of the country, and to those wines known in England by the name of *Oporto* and *Viana* Wines, so it must not be omitted, that the wines growing in the

the province of Estremadura are all brought to Lisbon to be shipped; I mean such as are designed for exportation; and are therefore, though very improperly, called Lisbon Wines."

"They are also red and white, as the *Oporto* and *Viana* Wines are, only with this difference, that as at *Oporto* the greatest quantity by far is red, and at *Viana* almost all red, especially what is exported; so from Lisbon they have of late brought rather more white than red."

"The *Lisbon* red Wines are generally richer and stronger, and of a deeper colour than those of *Oporto*, and are not therefore so much used to be drawn alone, being more luscious, and not to be drank in quantity: they are therefore generally mixed with *Viana Wines*, which are thinner and of a paler colour; and both together seem to make up the *Oporto* taste. So that now we hardly see any *Viana Wines*, or *Lisbon Wines* sold; I mean red; but being used together, in the making up of each other, are indistinguishable from *Oporto Wines*."

Oporto is the second city in Portugal for trade, especially for Wines, the growth of which is so much increased, since the high duties laid upon French Wines in England, that it has greatly enriched the country round; especially that part which lies on the *River Duoro*, for a great way up: this increase is such, that they now (in 1728) generally send to England above 20,000 pipes of Wine a year; whereas formerly they seldom sent above 1000.

Mr. *John Croft*, a member of the English factory at *Oporto*, in 1788, observes, that it was about an hundred and sixteen years ago that the Portugal Wines were at the first imported into England, and chiefly or principally about the reign of Queen Anne, on the decadence or falling off of the Florence vintages, that the wines from Oporto came into any sort of draught or use; for, before the intro-

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duction of the Ports, there were also imported the Ribadavia Wines from Galicia, a province in Spain, though of this sort there only used to come about two or three thousand pipes yearly. They were a thin sort of wine; the red not unlike what is called or termed in Portugal Palhete, or Methuen Wine, from one Mr. Paul Methuen, who was the first that mixed the red and white grapes together, and you may suppose a liquor nearly the same as red and white Port being mixed. When the demand for this sort of wine became greater than its produce, especially in a scanty vintage, it put some English super-cargoes who resided there and at Viana, * near Oporto, at that time, on teaching the Portuguese to cultivate the vineyards on the heights or mountains bordering on the River Duoro, from whence the district takes the name of Sima de Duoro †; it is about forty or fifty miles distant from the city of Oporto, where the harbour is, and where it runs into the sea. It is vulgarly called by the English factory residing there, the Wine Country; and from thence it is that the wines are transported and conveyed down to the city of Oporto in proper vessels, being a sort of lighters or keels.

At the first cultivation of the vineyards, owing to more care and labour being employed, and the summer seasons in Portugal being intensely and excessively hotter than of later years, the wines were then undoubtedly found richer, and of superior strength and mellowness to those produced at present; at least by the account of them from old people in that country. It is chiefly owing to the delicacy and tenuity of

* A Mr. Peter Bearsley, an Englishman, who resided at Viana as a factor, was the first who went to Oporto with the view, and for the purpose of speculating in the Port Wines; and on the road to the wine country, at an inn, he met with an elder tree, whose juice he expressed, and mixed with the ordinary wine, and found it had the effect of heightening and improving its colour.

† Sima, in Portuguese, is high, or up aloft.

Howel, in his Letter, says, Portugal afforded no wine worth the transporting in 1634.

of the soil, and its being at a proper distance from the sea, that the situation is certainly the best suited, or most favourable of any in Europe, for the growth of red wines of a superior mellowness or body, which, owing to the system of modern luxury, is so much familiarized to us by custom in England, and so much adapted to the taste and constitution of the northern climates, as to become a staple commodity; and an Englishman of any descent, condition, or circumstances, cannot dispense with it after his good dinner, in the same manner as he uses a piece of Cheshire cheese for pretended digestion-sake.

As vineyards are a long time before they can possibly come to maturity, or arrive at any degree of perfection, even with the greatest pains and care in the cultivating them, it may not be improper to enlarge a little upon this matter, it being a great argument against the late-projected scheme for planting and growing of vines in America, as well as the inconstancy of that climate. Such was the case with those of Sima de Duoro ; though the wines so immediately came into a repute in England, owing to many circumstances ; but first and chiefly to the bad produce of the wines of other countries, their falling off, and scanty vintages, as said before ; and secondly, to the advantage arising from the establishing a factory, or body of merchants, at Oporto ; so far considered as beneficial in taking off the woollen manufactures of England, under the sanction of those most valuable privileges ceded by John IV. King of Portugal, in the year 1654, to Oliver Cromwell, and the government of England ; from which time, for before that they went only as super-cargoes and returned again to England, we may date the first settlement of the English in Portugal : so that it does not appear, that Port Wines have been at all known in the northern countries of Europe above ninety or a hundred years at the furthest ; and even so late as Queen Anne's time, the importation was very small ; for it is related traditionally, that it was then customary in London, upon a meeting of two friends, to invite one the other to the

the tavern to drink; or, in vulgar phrase, to crack a bottle of Claret dashed with Port: this only to intimate the extreme scarcity of the latter, and the plenty of the former.

In the infancy of the trade, the first cost of a pipe of red Port in Sima de Duoro was about sixteen or seventeen pounds, and the duty in England very inconsiderable to what it is at present, or has been of later years; all which served, as well as the high demand they had, to encourage the Portuguese to attend to their vineyards, and neglect their corn-lands; for at that time of day the province of Sima de Duoro was chiefly corn-land; and, from the richness of the soil, and the fruitfulness of the country, afforded as fine a produce as any in Europe, and so great a plenty as it was never known, that the province of Entre Minho e Duoro, or Oporto, wanted grain of any sort; nor was it ever known, at that time, that any corn was imported or wanted from abroad, there being a regular and sufficient supply from that rich and plentiful province. But by the settling or establishing of the factory of Oporto, the mutual intercourse of the trade, and the encouraging demand from England for the wines, with the close attention of the natives to the growing and cultivating of the vines, it was soon seen, by degrees, that their corn-lands were changed into vineyards; and as the demand in England for the wines was still increasing, and even much greater quantities were called for there than what could be expected from the natural produce, the English factors and wine-coopers were induced to try the expedient of adulterating, and teaching the Portuguese to sophisticate them; and, according to the proverb, "What the lion's skin would not do, to eke it out with the fox's tail;" and this they effected principally with the juice of the elder-berry, inasmuch as a great many elder-trees were planted, and soon seen to flourish in the vineyards; the chief use of which was, not so much to increase the quantity, as to give the wine a colour, which was defective because the red and white grapes were squeezed and jumbled together as they promiscuously grew in the vineyards, and the giving

giving the wines a good deal of colour was, at that time, so much the more necessary, as in England they had been used to drink Florence wine, which is high-coloured; and it was entirely owing, as said before, to a scarcity of Florence wine, that the Port wines came into any sort of repute in England, as being a proper succedaneum for the other, being less racey and mellow than the Alicants from Spain; and such was the high demand for them, that the Portuguese taking our woollen manufactures in return, not only clothed, but enriched that province, and many of the religious houses and monasteries derived their principal support from it; for the friars and clergy having more speculative time, with great power as well as landed property (means very authoritative in so despotic a country) soon became possessed of the best-situated and most extensive vineyards, which duly became a principal and proper object for the English factory, their commissaries, or brokers, to have a recourse to, by the way of fixing on the purchase of wine in those situations, which afforded the greatest quantity of that liquor; not only as it prevented the trouble of tasting every farmer's produce of a few pipes or tonnels of wine, but to bring them together with the smaller quantities, that the purchases might be on an average, or a general allotment; or, what they term at Oporto, a batch; for the better purpose of doing which, it was necessary to secure these large lodges or repositories of wine, so termed, for the mixing such a quantity together, in a view of shipping or supplying their employers, or general correspondents in England, with as near as possible the same sort of wine, and reducing them at the same price or rate of invoice, least some of the wine merchants in England should take umbrage and offence at their wine not being the same one as another's, or dispute about the invoice-price not being charged in the same general manner.

After the English commissaries have bought up, or secured, as they term it, the great lodges, they go buying and picking up the single tonnels and pipes, and even grapes of the poorer sort, of farmers and

 vintagers

vintagers in the bica*; (which they term buying wines in the bica) and these, according to their quality, they either throw into the great heap, or reserve by themselves; for, as sometimes they even turn out the better wines, they generally term them superior in their invoice, and charge them accordingly at a higher price to the trade in England, or keep them for home-consumption and private use at Oporto. The vineyards that belonged to the Jesuits' convents or monasteries were of the largest extent, and the holy fathers were more eminently skilful in the management of them, as well as the making and composing the wines. Besides, they being in the highest and best situations, afforded a wine preferable, and which was bought at a dearer rate; and being stouter and stronger than common, went by the name of priest-port in England, and the great and fashionable demand for this probably added so much to the rents and revenues of their colleges, as to increase the number of their order, or of Jesuits; though providence, the alma mater and disposer of all things, did not entirely reserve its gifts in store for them, but dispensed its benefit equally to others; and the all-genial sun, which equally glances the divine influence of its rays on the just as well as the unjust, frequently brought about that, according to situation, the mellowness, or tenuity of the vintage, with other circumstances of soil or season, as easily to be imagined as related, a copious abundance should rise in one place where it had been wanted, or fall deficient in another where it had been enjoyed. To this it was principally owing, and sometimes to the husbandman's employing better pains and care, that the wine of the plebeian vassal should

* Bica, in the Portuguese language, means a heap.

By the treaty of privileges with Portugal, the English were allowed to have four established houses of commerce in the Brazils, which article of privilege they virtually possessed for many years, as appears by the ratification in subsequent treaties;—but this, and their being allowed to ship their inferior wines (which were not fit and suitable for the English market) to the Brazils, is now intirely forbid and done away by the laws of the Portuguese Wine Company.

should be deemed as good, and sold as dear to the purchaser, as that of the lord; and in consequence, that he should grow rich and emulate his superior in the necessary conveniencies and even luxuries of life; for it has been often seen and noticed at Oporto, that the meanest labradores, or farmers, of the district or territory of Sima de Duoro, after having, in a good year, sold their wines well and profitably, have come down to the city, and bought clothes of the richest brocades of France, and strutted with them in the streets like so many peacocks, and thus vied with each other in the gaudiness of apparel. This only by way of illustration, to intimate that very great fortunes and estates were acquired or raised even by poor peasants out of a few acres of desert, steril, and uncultivated lands; and this likewise to shew the very superior profit of planting and cultivating a vineyard, to the tilling of corn-lands; on which, Mr. St. Pierre, in his Treatise on the Cultivating the Vine, says, " That the produce of a vineyard is greatly beyond that of the same quantity laid out in corn-lands, or even in gardens, if ever so properly managed; for an acre of vineyard-ground commonly yields from ten to twelve muids of wine, one year with another. A muid is about fifty-one gallons; so it yields about three or four pipes; and there is besides the profit of the slips, which shoot up in great numbers, and which either may be converted into new ones, or sold, besides the profit of the grapes, whether for domestic use, or dried into raisins for foreign sale." The great emolument and advantage arising from the produce of the vineyards, and particularly of those in that district, was a sufficient inducement for the Portuguese to turn their corn-lands into vineyards; which measures naturally brought about, and that too in a short time, so general a want of corn, as, in a scarce year, portended a famine to that part of the country; and, at the same time such a redundancy in the quantity of wine as was astonishing; and though such an article was scarcely ever known to be imported from foreign markets, yet, in the year 1753, which was a very barren, dry, and steril year in Portugal, there was the greatest demand imaginable for foreign corn, and a

particular want of maiz, or Indian wheat, the sort most commonly produced and consumed by the peasants; however, a number of vessels, corn-laden, were seen to arrive from America, France, and almost all parts of the globe, and considerable fortunes were made by several merchants at Lisbon and Oporto, who speculated and traded in that commodity; at the same time you might have travelled over what is vulgarly called the wine country for almost a month together, and nothing but vineyards would strike your view. From the prodigious quantity of wines in a favourable year of vintage, and owing, perhaps, to double the quantity by adulteration, it happened that, in the year 1755, the wines were offered at about two and three pounds per pipe in the wine country; and even so they had hardly a sale for them, owing to the decrease in demand for them from England, which arose from the quantity of made wines, as well as the great adulteration there; and, as the wines were in general but ordinary of that vintage, the English factory not only neglected going that year to the wine country, as usual, to purchase or buy the wines, but sent remonstrating printed letters to their Portuguese wine-brokers, which were circulated about the country, purporting, that if the owners of the vineyards did not forbear the adulteration of the wines, they would not fail of getting a proper intelligence of the principal aggressors that way; and, in short, would not buy their wines of them at any rate, nor even give themselves the trouble of tasting them. This letter had such an effect on the wine country in general, and the vintagers in particular, who were very much disgusted at it, as well as aggrieved by not selling their wines to the factory, and by the English commissaries not repairing thither, as usual, for that purpose, and tasting their wines, that the Portuguese farmers and vintagers came down in a body to Oporto, and offered their wines to them at their own terms and price. But this was without avail, (chiefly owing to the circumstance as before related) and, therefore, they associated in employing deputies to go down to the court at Lisbon to represent their grievances, and the distress they laboured under from the English

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not buying their wines as before, and the great loss it was to the country and the province in general, as on the disposal of the wines depended its principal support. At the same time they produced to the then principal secretary of state, Sebastion Joseph de Carvalho, (afterwards Conde de Oeiras) the printed letter which the English factory had so very imprudently dispersed about the wine country, through the channel of their brokers, the substance of which letter was worded in the most comminatory and threatening terms of language, (according to the construction which they were pleased to put on it) though, in fact, it implied no more in plain English than this, That if the Portuguese did not leave off adulterating their wines, the English factory would not buy them. This, though nugatory or trifling in itself, and so considered at first by the vintagers, yet still served to make a principal handle and argument for establishing the monopoly of the Portuguese wine company at Oporto, a proceeding very fatal, as may be read in the annals of that country, for it was accomplished at the expence of blood and rebellion to Portugal, and to England of double the price for the wines that they used to be purchased at before; besides which, it was liable to be considered in the light of an insult offered by the English to the Portuguese, as the court would choose to take it; for when the deputies of the factory went down to Lisbon with a remonstrance, setting forth their grievances occasioned by this monopoly, in respect to a free trade, the hardships that they laboured under, particularly the infringement of their privileges, and the treaty of commerce, as acceded to them time out of mind, and ratified by the several kings of Portugal, the deputies were treated contemptuously by the secretary, then created marquis of Pomball; and when they named the British factory, he said, he never heard of any British factory but one, and that was on the coast of Coromandell, and that it was the highest piece of insolence for a handful of English to give themselves such consequence, by printing so dictatorial a letter, with the name of the English factory at the bottom, which was treating Portugal as scurvily and

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insignificantly as if it was the most petty republic imaginable, and not a kingdom that had an indisputable right to make its own domestic laws.

This finesse of the minister did in no-wise exculpate the certainly inconsiderate conduct and ill-advisedness of the factory in planning such a letter, which has since proved itself, in the instance of the wine company, which gave a severe check to the factory, and the extracting so many thousand pounds annually from England, and by the exorbitant price charged on the Port wines since this monopoly took place; nay, it was even advanced so far against them as to be inserted in the articles of the new laws of the company, that the English commissaries, as the minister stiled them, and resident at Oporto, were even anxious of having the company established, as plainly appeared by their own letter, which, at the interview, he produced to the deputies of the factory, and which he said they had handed about the wine country, and pretended that it was the principal reason of its taking place; nay farther, that it was for a mutual benefit, though at the same time the law of the company bore so hard upon them, that it appeared to be the intent of the said company to deprive the English entirely of the wine commerce, and by these indirect means to force them out of the kingdom.

This article of the shipping of wines being the only branch of the trade left to the factory, that was not quite engrossed by the Portuguese, by the institutional law of the company, they reserved to themselves the whole power over the wines, and there was to be a demarcation of a particular spot or territory of what they presumed to dictate to the factory to be the best and properest situations for wines, and which they termed factory wines, or such as they should deem most suitable for the English market; though it was equally impossible and absurd to attempt to ascertain this properly; for as those they selected were of the hottest situation, in a dry year the wines would naturally be too mellow, and even some years like syrup, and not at all useable

useable as a vinous liquor. The English were at the same time denied the liberty of mixing them with the wines without the demarcation; for it might happen from a great variety of circumstances, but more particularly from a better management, or more favourable season, that the vineyards in these more moderately warm situations might afford the better wines, which had frequently happened; for the sun, as before observed, equally sheds his beneficent rays on the just and the unjust. The wine of the poor peasant would sometimes please the English purchaser better than that of his arrogant lord; by this means they grew rich, and would even emulate him so far that, as Shakspeare expresses it, "The toe of the peasant should kibe the courtier's heel;" and many families were raised out of plebeian stock to vie in honour as well as riches with their superiors of more ancient and noble race. This more particularly clashed with the system of government which, being absolute and despotic, makes it a crime in the vassals or commonalty to become rich. This was as inimical to the state as superior power in the nobility; and where honour is the only shadow grasped at by all who are at any distance from the court, this was a motive, as well as that before-mentioned, for expelling the English factory from Oporto, and which induced the minister Pomball to mark out the line of district or allotment, including the vineyards only of the principal gentry and religious houses, and excluding those of the menial vintagers or farmers, rendering these last for ever incapable of producing wines for English exportation, or for the northern countries. This was intended to lessen, by degrees, the number of vineyards, particularly of those belonging to plebeians, so that their lands should be reconverted to the growth of corn; and the secretary of state rested it in this point of view, as the Dutch did with their spices, by consuming half the quantity, to enhance the value of the rest, which measure soon took effect by the arbitrary measures of the court, and in consequence of this monopoly; for as in the year 1755, a pipe of red port might have been bought from two to three pounds per pipe in the wine country at the first hand; immediately on the first setting up of the wine company

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they got up to eight and ten pounds per pipe; and their agents went on prosecuting their iniquitous measures, by forcing the English factory to buy wines only in this particular spot of the demarcation by indirect means, and in order to keep up the resalvo of not infringing the articles of the privileges, and the treaty of the supposed free commerce. It is true, that the factory might buy without the district, or where they pleased, but then they could not export or extract them out of the wine country, so that they had not the power of burning or distilling them into brandy, of parting or mixing them with other wines in their lodges or vaults; or, in short, of exporting them to England, which was the prime object of their trade; so that, in fact, the purchasing of these wines within amounted to little less than a prohibition to purchase those without the demarcation, though they might turn out ever so good; for they were held out to the English wine company as insufficient for exportation, though they still reserved to themselves the power of exporting them; all which was absolutely contrary to the treaty and privileges of an Englishman, either as a sojourner, or as settled in Portugal, and as acceded in the time of Oliver Cromwell. One of the articles of the treaty positively and expressly says, that the British nation might buy, when and where they pleased, in any part of Portugal, any sort, or genero, or commodity, of the growth thereof, and ship it off, without any let or molestation whatsoever. At the same time the wine company reserved to themselves the exclusive privilege of buying these inferior wines, as they pleased to call them, which they could either sell to the English factory, or ship to England on their own accounts, and in this manner greatly undersell them. It appeared, therefore, plainly to be the drift and very design of the wine company to keep up an exorbitant price for their choice wines, and by interfering, through their own medium, and clashing thus with the factory, in the end to reduce them to buy of the company, or oblige the English to quit the kingdom, which was tantamount, as it was impossible for people, of either spirit or property, to attempt carrying on any sort of business under such tyrannical restric-

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tions. This monopoly struck effectually at the root of the English treaty of the privileges, as may be seen clearly from the laws of its institution; vide Sect. 10, p. 23, and Sect. 33, p. 57, enacted Sept. 10, 1756, though couched in as evasive terms as possible.

However, since the decease of the late king, and the present accession to the throne, attended with the political discarding of the late minister Pomball, things have taken another turn, and though the wine company still subsists, there is a greater latitude shewn by them to the English, in respect to their purchasing of wines in the country, and a much greater allowance and indulgence from the Portuguese wine company in respect to a free trade, which was never brought about virtually by any proper requisition from our court, but has merely depended on the mercy of the Portuguese wine company, or the policy of the court of Portugal, which would not entirely expel the English factors from Oporto and the circumjacent places, as they generally employed a large capital of money in wines and the other generos or commodities of that country, for which purpose, since the institution of the company, a very large one was necessary, by reason that the wines were bought at double the price as before it took place, and the factory were obliged to keep their wines so long on hand in their warehouses in Portugal, as they were not demanded in sale from England of so considerable a time, it having become the custom, or fashion, there to use none but the oldest wines. Though the English remained in the country under the disagreeable circumstances of the loss of their trade, and the insults of the Portuguese, both in their persons and property, still they were in hopes of redress from England, and a removal of the grievances they lay under from this monopoly; but by reason of their connections and dependencies they were obliged to stay at least till such time as they could get in their effects. This the wine company were well aware of, so that it not only insured them a readier consumption for their wines, but it even rendered the wines a more staple commodity, and it enabled the Portuguese, who are natu-

rally usurers, to lend their money at an exorbitant interest to the less established houses, in point of credit, belonging to the factory, which they received again in purchase for their wines.

The institution of the wine company, as has been before related, struck effectually at the root of the English privileges in Portugal, and indeed at the civil rights of mankind in general; for I believe it is unprecedented, in Europe at least, or in any other country, that a traveller should not be at liberty to purchase, for his money, the genero or commodity of that country, and ship them off for his own, (if not prohibited goods) and carry them with him without any let or molestation whatever, except that of paying the king's duties.

The Portuguese set about establishing this company in the year 1756, when England was engaged in war with France and Spain, and they availed themselves of this critical conjuncture. Notwithstanding the repeated remonstrances made by the representatives of the English factory, and the Portugal merchants in London, to the minister, the grievances still lay unattended to, as Mr. Pitt, then secretary of state, was employed and entirely immersed in schemes and plans of war. This belligerent minister did not favour the commercial interest so much as he might have done, as fearful at the same time of giving umbrage to the court of Portugal, whose friendship we were then soliciting, because a rumour was spread about of their coming into the family compact with France and Spain, which gave the Portuguese an opportunity of treating the English merchants with great insolence and contempt; nay they even went so far as to threaten imprisonment, upon a very slight pretence, to the English consul at Oporto, and nothing was more common than their talking of expelling the English from their country. This conduct was considered so notorious, that it is handed down to us in history. Not to digress farther on this subject, I shall only add, that they used to say, that as the privileges were granted to Cromwell, who was an usurper, they were not obligated to observe them. Afterwards

wards, in the year 1762, when we saved Portugal from the Spanish yoke, their ratifying the treaty to the full extent should then most properly have been insisted on, as it was a fair and good opportunity for our government to have determined on the company's being abolished at that time.

The English privileges had existed from time immemorial in Portugal, but of late years they have been grievously infringed. A large collection of those granted by the several Kings of Portugal to the English, which were even superior to those enjoyed by the subjects of Portugal themselves, may still be seen. I do not know whether they should not properly be termed charters, as they are copied from the archieves of that kingdom, in the Torre de Tumbo, at Lisbon; but the most ancient were those of king Ferdinand, whose reign did not begin till 1367. There are several of John the First, his successor; to which, and several others granted by his predecessors, I refer my reader.

Davenant, inspector-general of the imports and exports, in his report to the Commissioners for stating the public accounts in the year 1669, says, that no Portugal wines were entered in the custom-house books at that time. It was only at the epoch of the restoration that the use of these wines became at all common in England, at which juncture they were chiefly imported from France and Germany. In king William's time, some wines were sent to England, but in no great quantity. In the year 1702 the war broke out with France and Spain, and the Portuguese joining the allies, the next year a new treaty, commonly called the Methuen treaty, was concluded upon that occasion by queen Anne, by which Portugal wines were to pay one-third less duty than French wines. From this time we may date the general use of Port wines in Great Britain.

At first the export was about 5000 pipes; and in the year 1780 it

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was found to be from 20 to 30,000 pipes a year. The wines about Viana, near Oporto, were at first in great repute. The wines of Sima de Duoro came in demand afterwards. It was about the beginning of the present century that Port wines first came into England, as already mentioned, and the quantity was about 5 or 6,000 pipes a year.

In the year 1701, the Duoro wines were sold in the wine country at 10 millreas, about 2l. 15s. per pipe; in the year 1731, at 48 millreas, about 13l. per pipe; in the year 1755 at 12 millreas, about 3l. per pipe; in the year 1779, at 30 millreas, about 8l. per pipe. This is only mentioned in reference to what goes before, with respect to the demand of the wines for England, or the small quantity in point of vintage.

The English supercargoes first established themselves under the sanction of the privileges granted by the court of Portugal and authority of England, in the year 1656, when Cromwell gave the patent of consul-general to one Thomas Maynard, with a patent of vice-consul to his brother, Walter Maynard, of the vice-consulship at Oporto, in the year 1659. It was only in the year 1727, that the British merchants or factors at Oporto in a manner incorporated themselves, and made certain rules for their proceedings, which have been observed with very little alteration ever since.

The best wines afforded at the vintage are, when there are fewest raisins among the grapes, owing to the extreme heat of the sun, or when, in consequence of the excessive rain, many of the grapes do not become so full as to burst; but still a little moderate rain at the time of vintage does good, as it plumps up the grapes and washes the dirt from them, affording them also a fine bloom. It is the skin of the grape which gives the colour to wine, and the thicker the skin, the deeper is the colour of the red wine. In a very hot season, at the vintage-time, the wines shall be ropy and thick like syrup; on the contrary, when too great a quantity of rain falls at the vintage, the red

grape

grape will be almost the colour of the white, and even require the juice of the elder to give it a proper red, though now all such sophistication of the wine is not only strictly forbidden in Portugal, but attended even with capital punishment and confiscation of the wine, as may be seen in the new Portuguese laws relating to the wine company. The Lisbon wines are so well known that there is no occasion to dwell much upon them; suppose the quantity not above 4 or 5,000 pipes that has come of late years to England; it is all now termed or promiscuously called Carcavello, though, in fact, it is a quite different wine, and so called from the village of Carcavellos, near the rock of Lisbon, were the late marquis of Pomball had a quinta or vineyard which produced yearly about 50 pipes of a much stronger and richer wine than the common sort of Lisbon wine, and it is charged at a much higher rate in the invoice to the wine merchant; and these wines, when good, and what is called a mellow vintage, are very rich indeed.

By the law of the general company of the Alto Duoro, it is expressly provided, that if the *sambucus fructus in umbella nigro*, C. B. P. or the alder tree, is found in or about a vineyard, the penalty of forty shillings shall be incurred;—and if any of the berries, or expressed juice, (which they term baga) is found or discovered in any lodge or repository of wine, besides the confiscation of all the wines of the said lodge to the company, the owner or proprietor is liable to be imprisoned at the mercy of the king.

This I knew put in execution, and several gentlemen of family and high rank in the wine country were sent to prison on suspicion only, some elder berries having been unluckily strewed in the path way ot their lodges, which might have been done through an evil design.

The Portuguese not being allowed to add the elder juice to their wines, is the reason why the port wines either come over of late years so deficient in colour, or lose it so soon, that they will not keep properly

in

in bottles above five years, without becoming pale and tawney. This, and the very small portion of brandy afforded to put in them, owing to the exorbitant price it is held up at by the company, the sole venders of it, is a very sufficient argument against the port wines being so long kept; as well as that the vintages, for many years past, have not afforded so rich or mellow wines as they formerly produced.

Sec. X. Of the law, stiled, The general culture of the vineyards of the Alto Duoro.

The principal object of this company is, the better to support the reputation of the wines, the culture of the vineyards, and at the same time to benefit the commerce which is carried on in this commodity, establishing for it a regular price, from which may result a competent convenience to those that cultivate it, and a respective gain to those who trade therein; avoiding, on the one hand, the excessive prices which render the consumption impossible, and therefore ruinous to the commodity; and on the other hand, avoiding its decline so much, that the vintagers cannot afford to support the annual expence of its culture. But as it is necessary for these useful ends to establish competent funds, the capital stock of the company shall be one million two hundred thousand cruzades, or Portugal crowns *, divided into actions of four hundred millreas each; the half of which may be advanced in competent wines, fit to receive, in which the actionists may be willing to interest themselves, and the other half shall be precisely in money, that the company may thus comply with its obligations of assisting the urgencies of the vintage and commerce in the following manner, viz. out of the abovesaid fund the same company shall lend to the necessitous vintagers, not only what may be precisely necessary for the cultivation and dressing of the vineyards, but also what more may suit them towards some of those minute expences which the preservation

* A Portugal crown is about two shillings and two-pence.

servation of human life makes daily indispensable, without taking of them for these loans an higher interest than three per cent. provided such loans do not exceed half the common value of the wines.

N. B. By the above article of this law of monopoly, it is obvious and very apparent, that the vintagers, and those possessed of wines, by entering them in the company's stock and magazines, become actionists, and may consequently exact their own price for them from the English.

Sect. XXXIII. "That the vintagers, and those who purchase of them, may govern themselves upon certain principles, so that neither the vintagers may pretend to reap from the sales gains prejudicial to the commerce, nor the commerce in the cheapness of the purchases of the commodity, may ruin the vintager, the company shall unalterably pay for all the wines which it takes for its embarkation, the prices of 25 and 20 millreas per pipe, according to their two different qualities, in such manner that, even in case of there being a great scarcity of the abovesaid qualified wines, and a great vent for them, those of the first quality may not exceed the price of 30 millreas per pipe, and those of the second 25 millreas."

The aforegoing Sections are here translated into English, as literally as the idioms of the two languages will admit of.

By a letter received from Oporto, dated December, 1787, says, the Portuguese rule over the English factory there with a rod of iron*, nor

* By the laws of the wine monopoly, or company, the British factory could not ship off any wines for Great Britain or Ireland, without their being first approved by said company's factors; and if they refused them as unfit, or not proper for the English market, the factor had no other alternative or mode of disposing of them, but by making an humble petition to the said company, to accept of them on their own terms of price.

The

nor do they attend much to the treaties pending, on the supposition that England connot dispense with their wines at any rate; especially as this year (1780) thirty thousand pipes have been demanded for Great Britain and Ireland.

A mill cruzados is about an hundred and forty pounds.

A millrea, five shillings and six-pence.

Thus far our author, Mr. John Croft.

THE CONCISE PROCESS, &c.

The grapes, when gathered from the vine, are conveyed in baskets to the lodge, where they are thrown into a large vessel called a lagar, they are there bruised by a large stone, and afterwards trodden by a number of men, who come from Gallicia, a province of Spain, to assist at the vintage; these men are employed in the lagar, according to the state of the grapes. If very ripe and fine, of course less time is required; but they are twelve or eighteen hours in general in the lagar. The juice of the grape is then left to ferment, by which means the skins, seeds, and the whole of the mark, &c. &c. rise to the top of the vessel, and cake together; the wine is then drawn off and put into

The Portuguese wine company sent samples of choicest wines to their then envoy, or minister in London, (Mello) to distribute as presents, and negotiate among our first nobility under the denomination of the king of Portugal's port; and it met a very candid acceptance as such.

into tonnels, holding in general from five to twenty-five pipes each, of one hundred and thirty-eight gallons the pipe; brandy is then occasionally added—About the month of December tasters are sent up by the Portugal wine company to taste these wines, who, after having tasted them, make their report of the quantity, as well as quality of the wines; which report is forwarded to the court, and the prices of the wine is fixed accordingly—the purchases are made about the middle of January. Previous to buying, an edict is posted up, declaring the price to be asked for the wines, as likewise the duty on the amount.

We have seen, its colour is frequently assisted and deepened by vino tinto, the juice of the *sambucus fructus in umbella nigris, C. B. P.* or other salubrious colouring matter. It is always exported in the wood, and reckoned not exportable without brandy.

The component parts of red port wine being omitted in the Table of Wines, page 13, I beg leave to observe here, that they consist, of highly rectified spirit, 2 *oz.* 5 *dr.* 0 *gr.*; thick, oily, unctuous, resinous matter, 1 *oz.* 4 *dr.* 0 *gr.*; gummy and tartarous matter, 1 *oz.* 3 *dr.* 0 *gr.*; and water, 2 *lb.* 6 *oz.* 4 *dr.* 0 *gr.*

When red port wines are imported into these kingdoms of a *thin* quality, wanting in *body*, or defective in *colour*; strong old Bene-carlo wine of Spain may be advantageously employed in making them up here, in Ireland and Scotland. The same may be said of the red Roussilon of France; both of which are used in making up Clarets for the Irish market.

There is nothing reprehensible in the making up or mixing of these wines for the different markets of Europe, when we come to consider, that they are the produce of the same kind of grapes, cultivated in

 Portugal,

Portugal, Spain, and France, owing their difference to climate, culture, and the manner of preparing them.

"In respect to Portugal wines, as far as may be judged, they are pretty much the same in quality; that is, of a heating or warm nature, but red port is more astringent and bracing, and therefore, for many reasons, to be preferred, where that property is required, though sometimes Must, or new wine just pressed, or brandy, is thrown in, to render it stouter, and check the fermentation, which makes it less wholesome; and this is, by the by, the great inherent mischief, as it were, in most of these sorts of wine; for, from not undergoing a due fermentation, the Brandy never properly assimilates or incorporates, but creates a raking or griping on the stomach, though, in fact, the spirit is frequently drawn from the same grape, or the same sort of wine, by distillation.* Still, however, it remains gross and ardent, from its nature, and not being of so fine a texture as the French brandy, and, consequently, being added to the wines when first made, in order to quiet the fermentation, and again before they are shipped off, because, without it they would not keep that length of time, that of late years has, through a kind of fashion, been required of them for use in England; the wine and the spirit never properly mixing, they must, of course, become vapid, and the vapidity plainly appears, if you compare them with French wines."

"There are forty different sorts of grapes in Portugal, and all of them suitable to a vinous liquor. The most common or general sort used in the fabrication of port wines is called there, the *Uvo Bastardo*, or bastard grape. It is of the smallest sort, about the size of an English sloe, grows quite close in the cluster, and has a remarkable thick tough skin."

This

* All ardent spirits are similar. When equally pure, they are equally fit for the above purpose; the spirit drawn from part of the same wine having no more affinity with it, than any other would have.

This variety may be more fully seen under FRENCH WINES, where the general mode of gathering, pressing, fermenting, and preparation of wine is brought into one point of view, with a description of the Vines from which they are produced. Their planting, propagation, culture, growth, &c.

VINO TINTO.

A thick, sweetish, black-red wine, formerly used for colouring other red wines, particularly red port, was made with the inspissited juice of the *Vitis Ideæ foliis oblongis, cranetis, fructu nigricante,* C. B. P. and the fermented juice of the *Vitis silvestris Labrusca,* C. B. P. That is, the wild vine, commonly called the Claret grape.

About eighty or ninety years ago the use of Vino Tinto was very generally superseded by the juice of the *Sambucus fructu in umbella nigris,* which was for many years continued, until the elder trees were rooted up, and the juice of their berries prohibited to be employed to assist the colour of red port wine, in the administration of the Marquis De Pombal.

WHITE PORT.

A Wine now as little used as *Red Lisbon,* differs little from red port, except in colour, as may be judged from the *Metheuen Port,* beforementioned, being the produce of the red and white grapes

expressed together, which, according to the pronounciation of the Portuguese, was called *Palhete,* from Paul Methuen.

It is the produce of the white grapes of Oporto and Viana, and prepared in a similar manner to the red port of these places, except that the rape and mark, consisting of the foot-stalks, husks, and seeds, are not fermented with the Must. It is a wholesome, and not unpleasant wine, mostly drank in the country, or distilled into brandy; and not a little of it converted to vinegar.

RED LISBON.

A well known wine, formerly much more used in these kingdoms than the white wine of that name, has long been used in the making up their red port, as before-mentioned, (page 45) to which it gives fullness and colour. It differs nothing in the culture, preparation, &c. from Port and Viana wines. There is very little of this rich wine converted into brandy or vinegar, or exported without lowering.

LISBON WHITE WINE

Is a pleasant-tasted wine, which still continues to be imported into these kingdoms, and at many respectable tables much esteemed; the genuine flavour of which has never been well imitated in these kingdoms;

doms; most of the dry white wines, of the growth of the Province of Estremadura, shipped at Lisbon, go under this name, white port excepted. Its culture, preparation, &c. is not very different from white port; the principal difference is in the *Vines*. A great deal of the small wines of this class are distilled into brandy, or converted to vinegar.

MADEIRA MALMSEY,

Originally the growth of ITALY; the Vines that produced this delicious sanative wine were transplanted by the *Spaniards* in the *Canary Islands* long previous to its becoming so much in request in *England*, as it was before the use of tea had gained ground in these kingdoms; a few glasses of which were usually drank after a meat breakfast. Subsequently, the Portuguese obtained cuttings and layers from *Palma*, one of the Canary Islands, from which they cultivated it, at *Madeira;* the Malmsey now most in estimation, is called *Madeira Malmsey*, a wine, comparatively in little use to what it was at the time above alluded to, consequently there is much less of it imported than formerly.

The acid principle which prevails in the Canary Malmsey, and for which it has been condemned by the author of the choice of wines, before-mentioned, is not to be found in Madeira Malmsey, and of course it cannot have the bad effect on the stomach he ascribes to it. If it did, it could be corrected during fermentation by a proportionately greater quantity of yesso than what is at present added.

It

It is prepared from very sweet, pungent grapes, the berries of which are mostly round and small, like those of the best currants imported from Italy and Greece. Among which, are the *Vitis Corinchiacæ sive Apyrina nigricante,* J. B. vulgarly called the Black Currant Grape. It is an early ripener, and has very little stone or seeds. It comes from Italy and the Morea.

The other is somewhat larger, and perfectly round, the juice is of a more luscious sweetness, and higher flavour, and equally as early a ripener. It is a good bearer, but the grapes upon the same bunch seldom ripen at the same time, so that they cannot be always gathered in full bunches, but picked in separate branches from the same cluster; when thorough ripe, they are among the richest grapes known, and generally ripen to perfection in Madeira. They are a species of the *Vitis acinis nigricantibus dulcissimus,* called in France, the Black Frontiniac.

To which is sometimes added, the grapes of the *Gros Noir d'Espagne,* that is, the Great Black Spanish; the *La Malvoise,* that is, the Malmsey Muscadine; two of the sorts of grapes in the catalogue of those that compose Madeira wine. In the gathering these grapes much caution is used to cut off the unripe and decayed parts of each bunch.

In seasons unfavourable to the produce of these vines, when the juice of their grapes were not sufficiently sweet, the Must was enriched by delicious syrups, and the flavour assisted by suitable aromatics of a salubrious quality, both cephalic and stomatic in their nature. I know of no other additions besides these aromatic syrups, than dried fruits and a little gypsum, the wine in general being sufficiently strong without brandy. It is much better fermented than Canary Malmsey, compared to which, it is a rich, yet a thin, light, delicate wine, much superior in every respect; bearing transportation, keeping much better,

and

and improving by age. For further particulars, see *Madeira Wine, French and Italian Wines.*

CARCAVELLO.

A small wine, very different from the Carcavello mentioned page 60. About thirty years ago this wine was in much greater request than at at present. There is some of it much drier than the common, which has something of the flavour of the Dry Mountain of Spain. It all growes dry by long keeping, but very little of it comes up to the Mountain flavour; in this respect it is more like the Mountain Malaga, which, though the produce of the Dry Mountain Malaga Grape, however dry it may prove by age, never arrives at the delicate flavour of genuine Dry Mountain. It is sometimes written Calcavella, and Calcavello.

PORTUGAL BRANDIES, were a very bad article until the beginning of the seventeenth century, when the English wine merchants got into the habit of sending over their coopers to Portugal to *make up* their wines, who brought over some distillers to teach the Portuguese a better method of distilling their brandies, than the old mode, which was, and might be truly called *burning* them, for they literally had a burnt flavour, from the gross manner in which they

they had previously distilled them ; the foul lees, thick bottoms, and but a small portion of the thin unsaleable wines, being incautiously distilled together, by which an empyreuma, or burnt flavour, became in a great degree unavoidable.

The advantages derived to the Portuguese, even in this case, proved of so much consideration, as to render their brandy a staple article of commerce, of great extent ever since. They have for these many years past made so much cleaner a spirit than formerly, that the importation of French Brandy into Portugal has long been prohibited. And since the ravages of the late war in the vineyards of France, the French have employed agents to buy up the Portugal and Spanish brandies to export into these kingdoms, instead of their own, which have been wanted to make up such of the wines of France, otherwise not exportable.

Previous to this, the Portuguese exported great quantities of brandy to their colonies in *Brasil* and *Africa*; in the latter of which, it had, for many years, been a staple article of commerce ; but they having gradually improved in making a cleaner spirit; it has found its way, as we have seen, to a better market. *See the Disquisition on Spirituous Liquors.*

In a few months after the conclusion of the late peace, I put the following statement into the hands of an eminent Distiller, who immediately availed himself of its contents.

Brandy, an article of commercial interest and ready sale, has been for some time rising, and must necessarily continue to rise, from the depredations made in the late war in the vineyards on the continent; can be advantageously made by the proposer in these kingdoms, equally as good and wholesome as any imported, and totally indistinguishable from the foreign.

The

The present juncture affords the fairest opportunity of advantageously embarking a capital in this undertaking, with equal security and success, as it will be many years before things can return to their former level, by which time the undertakers will have accumulated a large fortune, and be in possession of the trade.

The merchants in France are now, and for some time have been, buying up Spanish and Portugal brandies at one hundred and forty, to one hundred and sixty milreas per pipe, at seventy-two pence the milrea, which is from forty-two, to forty-eight pounds per pipe, to export as their own produce, in order to save their brandies, to make up their own wines; which is giving at the rate of six shillings and eight-pence to seven shillings and eight-pence per gallon for a brandy much inferior to what I can make them, at those or in these kingdoms, which is at about three shillings to three shillings and six-pence per gallon. This, when the duty of nine shillings and six-pence is paid here, amounts to sixteen shillings and two-pence, and seventeen shillings and two-pence per gallon import proof. The duty payable in England is under five shillings and six-pence for making brandy; in Ireland, three shillings and seven-pence per gallon; therefore, in the former, it can be made for eight shillings and six-pence and nine shillings per gallon; in the latter, from six shillings and seven-pence to seven shillings and one penny per gallon, and in France or Flanders from three shillings to three shillings and six-pence per gallon. These observations pretty accurately give the comparative advantages of making it in each country; for instance, in France, Holland, or Flanders, from three shillings to three shillings and six-pence; in Ireland, from six shillings and seven-pence, to seven shillings and one penny; and in England, from eight shillings and six-pence to nine shillings per gallon. In Ireland it can be sold from ten shillings and three-pence to eleven shillings and three-pence; in England, from sixteen shillings and two-pence, to seventeen shillings and two-pence; and in France, &c. from seven shillings and

eight-

eight-pence, to six shillings and eight-pence per gallon, at hydrometer proof. The profit on making it in England is from seven shillings and eight-pence to eight shillings and two-pence; in Ireland, for home-consumption, from three shillings and eight-pence, to four shillings and two-pence, and for exportation to England, the same, except their agent here sells it as French, then it will bring from nine shillings and seven-pence to ten shillings and one penny per gallon; but the making it in France and exporting it to England would stamp a currency on it, and procure from thirteen shillings and two-pence to thirteen shillings and eight-pence per gallon profit, without the least demurrer. This will inevitably be the case, as soon as the *war* is over, as large distilleries have been for some time erecting in *Languedock*, a maritime province, and may probably be shipped at *Nants*, which stands on the north bank of that stupendous river, the *Loire*, or *Loyre*, which rises in Languedock, and, by a meandering course, after traversing the greatest part of France, runs into the Bay of Biscay, about thirty miles below the great commercial city of Nants; which, so far back as 1720, shipped to England only about ten thousand tuns of wine and brandy annually. *See Distilling, Rectification*, &c.

SPANISH WINES.

Formerly, no country possessed better wines, or in greater variety than *Spain*. Ancient history bears testimony to the fact. *The wines of Spain* are at this day numerous, and many of them excellent. The Sherry, St. Lucar, and Teneriffe wines are deservedly in high estimation in these kingdoms, particularly in London; as was formerly *Canary Malmsey*. The Malagas, or Mountain wines, so well known in England, are of two sorts, *dry* and *sweet;* the Pedro Zimenes,

Zimenes, a rich wine of the same species, is not so well known; the majority of the grapes that produce these wines are of the Malmsey kind, particularly those from which the wine called *Mountain Malaga* is prepared; the dry Mountain is a very good and wholesome wine, of an agreeable flavour, and sound quality, improving by age,—it is a valuable wine; the luscious sweet Mountain Malaga deservedly has its admirers when genuine. The Vino Blanco de Vals is a *sweet* wine when new, that grows *dry* as it advances to maturity; a property common to most of the *white wines of Spain,* and very conspicuous in the Sherry and Teneriffe wines. The Sitges is a sweet wine, of a very agreeable flavour, the produce of a village in the neighbourhood of *Barcelona;* this wine is suspected by some authors to be the *Malvasia,* from Epidaurus, a city of Greece, from whence it was transplanted into Spain. Their Muscadel partakes a good deal of this quality, and is a wholesome stomatic wine, deserving of being more generally known. The *Ribadavia,* of *Riojo,* in *Castile,* is an agreeable white wine, of some excellence, as is the *La Mancha* of the same province, a very good *red wine.* The *Paxeret,* or *Pacharetti,* is a rich, full, sweet, white wine, of *Andalusia.* The *Macabeo,* of *Catalonia,* is a sweet white wine, that improves very much by age.

Nor are the Red Wines of Spain less numerous, or inferior in excellence to the *white.* The *Mataro,* a red wine of *Catalonia,* tastes like a mixture of rough *Claret* and strong-flavoured *Port,* but somewhat harsher and more *earthy,* or less *vinous.* There are two other red wines of much the same quality, but inferior in strength, that made their way into these kingdoms about thirty years ago, under the name of *Ribas* and *Reus,* shipped at *Barcelona.* *Bene Carlo,* a strong, full-bodied, deep-coloured, red wine, of *Valencia,* well known to the trade, from its use in making up the weak *Clarets* and *Ports* of France and Portugal. At the little port of *Bene Carlo* are annually shipped from twelve to fifteen thousand pipes, four thousand of which are imported into *Bourdeaux.* The *Vineros* and *Murviedro,* are

wines of the same quality, but neither so strong or high-coloured as the Bene Carlo; therefore not so fit to mend the colour and strength of Claret and Port wine. The *Tintos de Alicante,* rich, sweet, red wines, are mostly sent to Bourdeaux to make up their Clarets of inferior quality; in themselves they are a cordial, not unwholesome wine. The *Tinto de Roto,* of *Andalusia,* a wine we call *Tent,* is a sweet, pleasant, red wine, not in equal demand to what it was formerly. The *Valdepenas* and *Foncaral,* of *Castile,* are both pleasant, light, wholesome, well-flavoured, red wines, with which we ought to be better acquainted. The *Garnacha* and *Tento de Montanas,* are very strong, sweet, red wines, used chiefly to colour and strengthen other red wines, and are the produce of *Catalonia.* On the *Lepardum,* or *Epardum,* I shall be silent for the present. The *Saragosa* and *Carinena,* are rich cordial wines of *Aragon,* of much estimation in the inland part of the country.

Palma, or Canary Malmsey, or Seck, having the same origin as Madeira Malmsey, we may refer to what has been said on that head, under Portugal Wines, and have here only to observe, that the *Palma,* or *Canary Malmsey,* is prepared from the same grapes, in the culture of which they are much improved of late years; but whether it is owing to the soil, climate, or culture, or to any unheeded difference in the gathering and pressing, or the subsequent management of the wine in its progress to maturity, it certainly has an acid quality, very perceptible to the palate, which is not prevalent in the Madeira Malmsey. It is a much fuller and more glutinous wine, therefore apparently richer, and more like the original *Malmsey,* formerly imported from the Canary Islands, of which *Palma* is one, and *Grand Canaria* another, to which it probably owed its name of *Canary Malmsey,* the consumption of which has so very much declined in these kingdoms, that there is comparatively but very little of it cultivated; which may, in some degree, account for its degeneracy, as it would be to little purpose to bestow much labour and pains in the

culture

culture of a wine for which there was no considerable market; if a demand for it should ever return, from the improvements lately made in the culture of the wines of the Canary Islands, particularly at *Teneriffe,* there is reason to expect a much better Malmsey could be made, to which the more liberal use of Yesso might largely contribute; this might be assisted with the modern mode of bringing down thick *Sherries,* by frequent rackings, and, finally, diluting with a thinner wine of the same nature. *See Sherry.*

From Dr. Barray's account of the wines of the ancients, they were mostly of this thick quality, to which, and the age it enabled them to endure, they owed much of their strength and excellence. The following is the favour of an old friend, who resided at Teneriffe for many years, and lived there when I was in the island, and recently assisted me with the following information, being now a resident in London.

TENERIFFE WINES.

The Wines of that Island are produced from the same Grape as in the Island of Madeira.

Teneriffe Malmsey. In former times, say before the use of tea, this wine was much drank in England. It is made from a small grape of the same name (originally imported from the Island of Candia); the bunches are allowed to remain on the vine till that the whole is most thoroughly ripe; and when carried to the press, any that may be spoiled are taken away; the grape is then pressed and put

put into the wood to ferment; after some months, the clear liquor is drawn off from the lee; and with a couple of finings with isinglass, becomes clear, and fit to set aside to improve by age. Seldom is Brandy put into Malmsey wine; but when that is the case, always the best Coniac. It is a perfect mistake to say, that dried fruits, aromatic syrups, or any thing of the kind, are ever made use of in the preparing of *Teneriffe Malmsey.*

Of all sweet wine known, this Malmsey is certainly the richest, at the same time there is attached to it an acidulous tartness, which renders it pleasing to the palate; all strangers who visit the Peek are cheered with it in their ascent during the pinching cold, when other wines appear to them as tasteless.

The common wine, denominated *Cargo,* is made principally from the Malmsey grape, with sometimes a small addition of a dry grape, called Vidonia. When ripe, they are gathered and carried to the press; pressed, and put into the wood to ferment; after some months, the clear liquor is drawn off, and a certain quantity of brandy added; (the brandy so used is made from the gross lees of the wine, and from the thin wines of the country) and after two or three rackings, and fining with isinglass, it is set aside for exportation.

This is the wine which, from its acidulous tartness, has been found so peculiarly beneficial in counteracting that scorbutic tendency which so frequently occurs in our navy and army, both abroad and *at home;* insomuch that it has been greatly in use of late years, and by its means many valuable lives have been preserved to the country. The use of spirits, however diluted, are now exploded by all our army and navy commanders, and never resorted to when the Teneriffe wine can be had; and which they find, by experience, stands all climates.

The

The best wine, denominated *Particular,* is made from a variety of the *dry* grape—These are, Verdello, Listan, Vidonia, Negramuello, Tintillo, Gual, &c. The whole, when perfectly ripe, are pressed together, but not separated from the stem or foot-stalk; allowed to ferment, and to remain in the legar or receiver of the press for days together, during which is added the powder Yesso; this assists fermentation, and rectifies any superfluous acidity; the liquor is then passed to the cask to finish its fermentation; after three or four months the clear liquor is drawn from the lee, and a suitable quantity of the best French Brandy put to it; after a few rackings it is set aside to improve by age.

From the very particular care and pains taken in the culture and preparing this wine it has got into great repute (its quality resembles the good wine of Madeira more than any other white wine) in the East Indies, in the West Indies, in America, and in the northern markets of Europe, equally so in this country, where it is now drank at the first tables.

The Brandies of Teneriffe are made from the thin wines of the country, not of sufficient strength to export; also from the gross lees of the different wines. These brandies are used in the common wines, but not in the *particular wines.* Great quantities are exported annually to Cuba and South America, where it is much esteemed, and a higher price paid for it by the natives than for any of the brandies of Europe, however choice.

The Teneriffe wines are mostly shipped at *Santa Cruze,* the safest and most commodious port on the island, where they are sent in small vessels; the greatest quantity come from *Port Orotavia;* hence some of the *Vidonia,* or Teneriffe wines, are called *Orotavia.* I have seen a sample of an excellent, delicate, sweet, wine, at this gentleman's * table,

* Mr. Little.

table, which surpassed any *Constantia* I ever tasted; it had something of the taste of *Tocay*. He gave me to understand he had then cultivating, at the Island of Teneriffe for the London market, a plantation of the vines that produced it.

The Spaniards are more disposed to convert their pricked wines and lees of wines to brandy than vinegar; hence their vinegar has not become an article of commerce.

SHERRY * AND ST. LUCAR WINES.

Wines deservedly more used than formerly in these kingdoms, particularly in *England*, are the produce of grapes somewhat similar to those from which *Madeira* is made—They differ in the culture, gathering, and in being exposed after gathered for a certain time to the sun, and are sprinkled with a calcareous earth divested of its fixed air, or carbonic acid gas, previous to their expression. In the press they are sometimes sprinkled with *brandy*, to resist the too great fermentescence excited by the calcareous earth; when committed to the butts for fermentation, they not unfrequently receive a further addition of spirit, and more frequently in the racking and making up for exportation, as is particularly explained in the sequel. The process for preparing Sherry wine.

First, The grape being gathered from the tree, is exposed to the sun, and some quick lime thrown over it. This is done for the purpose of molifying the fruit, lessening the coarseness of the skin, and rendering the extraction of the juice easier and more abundant.

Secondly,

* Formerly called *Xeres*.

Secondly. When the grape has been thus exposed to the sun for a certain time, more or less, according to the judgment of the persons who superintend, then it is thrown into the press (called legar) a thing similar to the machine known in England for making cider; when it is thrown therein, the first process is to sprinkle a quantity of coarse brandy on the grapes; after which two, three, four, five, or six men walk, with wooden shoes, over these grapes, squeezing them; and, the whole being afterwards gathered into a small compass, four boards are placed, forming a square room, in which these grapes are put, and by means of a screw placed directly over, they are pressed till all the juice is out, and the whole of the marc forms a substance equal to a piece of timber.

Thirdly. The juice being extracted from the grape, it is put into a butt, and a quantity of brandy added to it (the quantity is according to the judgment of the persons who superintend); the wine then goes through its regular fermentation, but as it often happens that the Levant winds turn much wine into vinegar, it has been found lately, that by forcing a second fermentation, it saved much wine being lost; which is done by removing the wine at the time the first fermentation begins to drop, into a warmer cellar, the heat of which causes the wine to ferment once more, and thereby every bad quality (caused by some of the grapes not being ripe enough perhaps, and perhaps some rotten) is destroyed.

The wine, after this fermentation, is almost as thick as treacle; towards Christmas it is racked, and a small quantity of brandy put into it; in February (latter end) racked again, and brandy put in; when March comes, you must taste your wines often, and be ready as soon as you find any that begin to turn sick, to rack the same, and give it some assistance with brandy to prevent its turning to vinegar. The time of danger is from March till June, after which it is hardly ever the case that any wine is lost.

The person from whom I had the above process of making *Sherry wine*, was a very considerable wine planter, and wine merchant, born on the spot, and used to the preparation of Sherry and St. Lucar wines all his life. Yet I have met with some respectable wine merchants who disputed sprinkling the grapes in the wine press with brandy, on the ground of it being of no use. I could only reply, that it might be to prevent, or curb, the fermentation, that the lime might exert when the juice began to be trodden out in the *legar* or trough of the wine press; an effect it certainly would have. I have not room to be so diffuse on this contradiction, as I have been on an objection started by some wine merchants, denying the practice of pressing red and white grapes together, in the old process for making *red port*. See pages 46 and 61 of this *Appendix*, where I have left it to *Mr. J. Croft* to answer them on that head; and where they may see the practice at large, and how it afterwards came to be discontinued. There are several of the *wines* before enumerated highly deserving of a particular description, both *red* and *white*, which I cannot enter into at present; and perhaps none of the *whole* more than the *sweet* and *dry* mountain Malagas. Among the *red*, some that have recently become an object of commerce; and none more than those now used in the navy. In 1721 the amount of the Spanish wines imported into the port of London only, was fifteen thousand seven hundred and thirty-six pipes. This may serve as a clue for estimating the extent and advantage of their wine trade with these kingdoms.

FRENCH WINES.

There is scarcely a province in France which does not produce wine. Languedoc and Provence afford the *sweetest,* and Champagne, Provence and Burgundy the best and *strong wines* ; if we except those named the Vin de Tiquere, so called from their being *sweet, full-bodied* and *spiritous.* The wines of the northern part of France, as Picardy, together with those of Guienne, (which last are shipped at Bourdeaux) are the Claret, Hermitage, Vin de Grave, &c. so much admired in these kingdoms; the Velteline, so called from the grapes being laid on straw before they are pressed; the Vin de Beaume, or Partridge Eye; the Cote Rote, St. Lawrence, Frontigniac, Muscat de Lion, &c. of Orleans, those about Paris and in the middle of the kingdom, are in general excellent. Several of those wines, and others not enumerated, as Roussillon, and the Bene Carlo of Spain, are used by the Dutch, Guernsey, and Jersey people to part, or brew and make up such wines as they procure from Spain, Portugal, Hungary, Germany, and Italy, for the purpose; to these may be added the more ordinary wines of commerce, *white* and *red:* the *Vins Blancs,* or white wines, consist of the *Muscat Rivisaltes,* Frontignac, of two sorts; Lunel, Montbazin, Beziers, of two sorts; two sorts of Picardan, Charette de Calvison, two sorts of Hermatage, Saint Peray, Condiceux, Laudun, and Malaga. *Vins Rouges,* or red wines; two sorts of Hermatage, Crose, Gervan, Cornas, Cote Rote, of two sorts; Saint Genies, Orsan, Condoulet, Chuselan, Tavel, Lerac, Roquemaure, Saint George, Saint Dresery, Saint Cristol, Langlade, Uchaud, Millaud, Saint Gilles, Sauvain, Vendres, Narbonne, Beziers, Rousillon; and many more in common use. There is no country of which it may be so truly said, that their wines are as numerous as excellent, and as sanative as agreeable.

Great as their variety, and extensive as their culture, so much greater was their demand for them from these kingdoms (if not their only, yet their principal customers) before their frequent hostilities with *us* gave the *Spaniards* and *Portuguese* an opportunity to beat them out of the market, as may be seen under *Portugal wines,* that they were obliged to lengthen out their inferior wines with the wines of Spain, although a severe law existed forbiding such practice; yet it was connived at, as it increased both the value and quantity of their own wines, and enabled them to supply the increasing demand. The addition of the *Spanish wines* would not have very materially injured the *weak French wines,* if they naturally incorporated and preserved their union and transparency; but this cannot be obtained without *forcing* them into a new fermentation, which adds more spirit to the *Spanish wine,* while it enervates the *French* wine, entirely confounds or dissipates its native delicacy and flavour, giving the *compound wine* a tendency to acidity. However disadvantageous this may be to the quality of wine, Dr. Sir *Edward Barry* observes, that they are more injured after they are imported by our modern artists, who mix them with other fermented liquors, and endeavour to unite them by a repeated fermentation, which further promotes their acid tendency. A practice borrowed from the Dutch, which they call *fretting-in,* who do it by confining the gas generated by the low fermentation, which curbs the vigour of the fermentative process, and causes the compound to assimilate, to which the absorption of the gas does not a little contribute, and at the same time prevents the dissipation of the flavour, that would in a great degree escape with the eruption of the fixed air, or gas, which contributes to its vinosity. Thus the *French factors,* by first mixing their wines with those of *Spain,* and raising their price, depreciated their character, and lost their commission business. The proprietors of the vineyards applied to the Parliament of *Bourdeaux* to procure a law, that no wines should be exported in future, that had not a stamp, ascertaining they had not been mixed with Spanish wines; this of

course

course has been strongly opposed by the *factors* and exporters. Wines, like people who have lost their character, seldom recover it. The export of wines from *Bourdeaux,* in 1721, was eighty thousand pipes, of brandy fifty thousand pipes, which will be much increased from the manufactories recently erected in *Languedoc* for preparing brandy from other materials than wine, which may be brought down by the river *Garrone* to *Bourdeaux.* About forty miles up this great river, on the south side, stands this immensely large and populous city, beautifully situated, rural, and yet magnificent. Here one of our kings, Richard II. was born, when Guienne was in our possession, of which province Bourdeaux is the chief city. It was given up in the reign of Henry VI. of England, after a possession of near three hundred years.

Under the head of *French and Italian Wines,* I mean to describe the planting of the *vine,* the culture, and management of the *vineyard;* the gathering and pressing of the *fruit,* and the fermenting of the *Must,* with the treatment of the *wine* in its progress to maturity. The French, taking the lead of all other nations in this great commercial branch of agriculture, they are certainly the best masters to study the preparation and management of wines under.

The clarets that were made at Lafitte, Latour, Pontac, Chattau, Margouze, Haut-Brion, were admirable; but interest having whetted invention, the vin de Bourdelois, like many others, has become dearer and less pure than they were sixty years ago. Here follows a full and explicit account of the *vines* usually made choice of in the *wine of commerce.*

THE

THE VINES AND GRAPES OF FOREIGN WINES.

I. *Vitis Sylvestris Labrusca,* C. B. P. The wild vine, commonly called the claret grape. This sort of grape is pretty well known in England; it has a berry of a middling size, of deep-black colour, covered over with a bloom like a plum, which may be wiped off; the juice stains of a deep-red colour, and before it is quite dead-ripe, is of an austere taste; the bunches are pretty large, but short, having commonly two side-bunches or shoulders on the upper part of the bunch; the leaves of this vine are jagged, and change to a deep-red colour before they fall off. II. *Vitis percæcox Columellæ, acinis dulcibus nigricantibus,* the Black Morillon. This is called in Burgundy, Pincau, and at Orleans, Auverna. It is a very sweet grape, of a middle size, somewhat oval, and a fine black colour; the bunches are somewhat longer than those of the former. This makes very good wine. III. *Vitis uva prampla, acinis albidis dulcibus durioribus. Tourn.* the Chasselas blanc. Bar-Sur-Aube, white Classelas, or Royal Muscadine. This is a large white grape, and grows close upon the bunches, which are also very large, and have commonly two small side-bunches or shoulders proceeding from the upper part of the bunch; the berries, when full ripe, if well exposed to the sun, change to a pale amber colour; the juice is very rich, and the fruit is commonly ripe early in September. IV. *Vitis uva perampla, acinis dulcibus, nigricanbus. Tourn.* The Chasselas Noir, *i. e.* the Black Chasselas; this is very often called the black Muscadine. The berries of this are as large as those of the former; the bunches are commonly larger, and are somewhat later ripe; the juice is very rich. If well exposed they bear well, and are ripe toward the end of September. V. *Vitis uva perampla, acinis dulcibus, rubentibus. Tourn.* The red Chassilas; this is also called the red Muscadine. The berries of this sort are a little larger than those of the former, and grow much thinner upon the bunches, are of a faint-red colour, and the juice is very sweet, but later

later ripe, upon which account it is not so valuable in England. VI. *Vitis acinis albis dulcissimus, Vitis Opiana,* C. B. P. Garidal. The Muscat, or white Frontiniac, the berries of this kind are larger, and grow extremely close upon the bunches, which are very long, and have commonly two shoulders to them; the fruit, when ripe, has a rich musky flavour; but it is commonly very late in the autumn before they ripen, and the berries being so very close upon the bunches detain the moisture in their middles, so that they commonly perish; to prevent which, some very curious persons look over their vines soon after the grapes are formed, and with a pair of scissars cut out all the small ones, whereby the sun and air are easily admitted, which dissipates the moisture, and prevents their perishing. This sort is a great bearer. VII. *Vitis acinis rubris nigricantibus dulcissimus. Garidel.* The Muscat Rouge, or Red Frontiniac. The berries of this kind are of the size of the former, but grow much thinner on the bunches; it is higher flavoured, and when thorough ripe, is the richest grape yet known; but this must have a very dry soil, and a south-east aspect, otherwise it seldom ripens well in England. VIII. *Vitis acinis nigricantibus dulcissimus.* The Black Frontiniac. The berries of this kind are less than the two former, but are not so high flavoured; their juice is sweet, and they are earlier ripe. This is a good bearer, but the grapes upon the same bunch seldom ripen at the same time, so that they cannot be gathered in full bunches, but must be picked off singly as they ripen. IX. *Vitis Damascena. H. R. Par.* The Damask grape. The berries of this kind are very large, black, and of an oval form; the bunches are very large, and the vine produces vigorous shoots. This ripens late in England. X. *Vitis præcox acino nigro, dulci and rotundo.* The Black Sweet-Water. This is a less grape than the former; it is of a fine black colour, and grows pretty close upon the bunches; its juice is sweet, and it is early ripe. XI. *Vitis alba dulcis.* The White Muscadine. The berries of this kind are larger, of a white colour, and the juice is very sweet; the bunches are long, and it is early ripe. XII. *Vitis Allobrogic Plinii. Car. Steph.*

Præd.

Præd. Rust. The Raisin Grape. This is a large oval grape of a blackish colour, when ripe; the bunches are very large, and make a fine appearance, but never ripen well in England. I have known some persons who had a great quantity of this sort of grape, which they commonly cut in the middle of October, with pretty long stalks to the bunches, and hang them on strings in rows in their kitchen, at such a distance as not to touch each other; and about Christmas, these grapes would be so ripened by the warmth of the rooms, as to eat extremely well. XIII. *Vitis irva perampla, acinis nigricantibus majoribus.* The St. Peter's Grape, or Hesperian. The berries of this sort are very large, round, and of a deep-black colour when ripe; the bunches are very large, and have two shoulders to them, the juice is very rich, and a little tinged with red; the leaves of this sort are remarkably jagged, so as to be known when there is no fruit upon the vines; it is late ripe. I believe this is the same sort which the French call *Gros noir d'Espage, i. e.* Great Black Spanish. XIV. *La Malvoise, i. e.* the Malmsey grape, is a middle-size fruit, of a muddy-red colour; its juice is very rich and soft, the bunches are large, and it is a great bearer; this ripens towards the latter end of September. XV. *Malvoise Musque, i. e.* the Malmsey muscadine. This is a middle-sized grape, rather long than round, of a rich musky flavour when ripe; this is one of the sorts of grapes from which the Madeiria wine is made. It ripens late in England. XVI. The Black Hamburgh, or Warner grape. This has a middle-sized berry, rather long than round, of a fine black colour when ripe; the juice is very rich, somewhat inclining to a musky flavour. This ripens about the middle of September. It was brought into England by Mr. Warner, with the former. These are the principal vines, from which most wines are obtained; but there are many more of less consideration.

Culture. All these sorts of vines are propagated either from layers or cuttings, the former of which is greatly practised in England; but the latter is what I would recommend, as being much preferable

preferable to the other; for the roots of *vines* do not grow strong and woody, as in most sorts of trees, but are long, slender, and pliant; so that when they are taken out of the ground they seldom strike out again, but shrivel and dry, so that they rather retard than help the plants in their growth, by preventing the new fibres from pushing out; for which reason I had rather plant a good cutting than a rooted plant, provided it be well chosen, as there is less danger of its not growing. But as there are few persons who make choice of proper cuttings, or at least that do form their cuttings rightly, it will be proper to give directions for this work in the first place, before I proceed. You should always make choice of such shoots as are strong and well ripened, of the last year's growth; these should be cut from the old vine, just below the place where they were produced, taking a knot of the two-year's wood, which should be pruned smooth; then you should cut off the upper part of the shoot, so as to leave the cutting about sixteen inches long; now, in making the cuttings in this manner, there can be but one taken from each shoot; whereas most persons cut them into lengths of about a foot, and plant them all, which is very wrong; for the upper part of the shoots are never so well ripened as the lower part, which was produced early in the spring; so that if they do take root, they never make so good plants; for the wood of those cuttings, being spongy and soft, admits the moisture too freely, whereby the plants will be luxurient in growth; but never so fruitful as those whose wood is closer and more compact. When the cuttings are thus prepared, they should be placed with their lower parts into the ground, in a dry place, laying some litter about their upper parts, to prevent them from drying; in this situation they may remain until the beginning of April, (which is the best time for planting them) when you should take them out, and wash them from the filth they have contracted; and if you find them very dry, you should let them stand, with their lower parts in water, six or eight hours, which will

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distend their vessels, and dispose them for taking root. Then set about preparing the ground where the plants are designed to remain, (whether against walls, or for standards) for they should not be removed again. But as I intend hereafter to treat in particular about the planting and management of *vineyards*, so in this place I shall confine myself only to such as are planted either against walls or pales, for eating.

Soil. In preparing the ground, you should consider the nature of the soil, which, if strong and inclinable to wet, is by no means proper for grapes; but where it thus happens, you should open a trench against the wall, which should be filled with lime-rubbish, the better to drain off the moisture; then raise the border with fresh light earth, about a foot thick, so that it may be at least a foot above the level of the ground; then you should open the holes about six feet distance from each other, putting one good cutting into each hole, which should be laid a little sloping, that their tops may incline to the wall; but must be put in so deep, that the uppermost eye may be level with the surface of the ground; for when there are two or three eyes left above ground, as is the common method used by the English gardeners, they all attempt to shoot, so that the strength of the cuttings is divided to nourish so many shoots, whereas, on the contrary, it is all employed on one single shoot, which consequently will be much stronger; besides the sun and air is left to dry that part of the shoots which remained above ground, and often prevents their buds from shooting. Thus, having placed in the cuttings, you should fill up the hole gently, pressing down the earth with your foot, and raise a little hill just upon the top of the cutting, to cover the upper eye quite over, which will prevent it from drying. This being done, there is nothing more necessary, but to keep the ground clear from weeds, until the cuttings begin to shoot, at which time you should look over them carefully, to rub off any dangling shoots, if such are produced, and fasten the main shoot to the wall, which should be constantly fastened

fastened up, as it is extended in length, to prevent its breaking or hanging down. You must continue rubbing off all lateral shoots which are produced, leaving only the first main shoots; and be sure to keep the ground constantly clear from weeds, which, if suffered to grow, will exhaust the goodness of the soil, and starve the cuttings.

PRUNING. The Michaelmas following, if your cuttings have produced strong shoots, you should prune them down to two eyes, (which, though by some people may be thought too short, yet I am satisfied, from several experiments, to be the best method); the reason for advising the pruning of *vines* at this season, rather than deferring it till spring, is, because the tender parts of those young shoots, if left on, are subject to decay in winter, and imbibe some noxious matter from the air, which greatly weaken their roots, so that if they are cut off early in autumn, the wounds will heal over before the bad weather, and thereby the roots greatly strengthened. In the spring, after the cold weather is passed, you must gently dig up the borders to loosen the earth; but you must be very careful in the doing of this, not to injure the roots of your vines; you should also raise the earth up to the stems of the plants, so as to cover the old wood, but not so deep as to cover either of the eyes of the last year's wood. After this they will require no further care until they begin to shoot, when you should look over them carefully, to rub off all weak dangling shoots, leaving no more than the two shoots which are produced from the two eyes of the last year's wood, which should be fastened to the wall, and so from this till the *vines* have done shooting; you should look them over once in three weeks, to rub off all lateral shoots as they are produced, and to fasten the two main shoots to the wall, as they are extended in length, which must not be shortened before the middle of July, when it will be proper to nip off their tops, which will strengthen the lower eyes. And during the summer season, you must constantly keep the ground clear from weeds; nor should you permit any sort of plants to grow near the

m 2 vines,

vines, which would not only rob them of nourishment, but shade the lower parts of the shoots, and thereby prevent their ripening; which will not only cause their wood to be spongy and luxurient, but render it less fruitful.

Second pruning. At Michaelmas you should prune these again, leaving three buds to each of the shoots, provided they are strong, otherwise it is better to shorten them down to two eyes, (for it is a very wrong practice to leave much wood upon young vines, or to lay their shoots in too long, which greatly weakens the roots); then you should fasten them to the wall, drawing each of them out horizontally from the stem; then, in the spring, dig the borders as before.

The third season you must go over the vines again, as soon as they begin to shoot, rubbing off all danglers, as before, and training in the leading shoots, (which this season may be supposed to be two from each shoot of the last year's wood; but if they attempt to produce two shoots from one eye, the weakest of them must be rubbed off, for there should never be more than one allowed to come out of an eye). If any of them produce fruit, as many times they will the third year, you should not stop them, (so soon as generally practised upon the bearing shoots of old vines) but permit them to shoot forward till Midsummer, at which time you may pinch off the tops of the shoots, for if this were done too loose it would spoil the buds for the next year's wood, which, in young vines, must be carefully preserved, because there are no shoots laid in on purpose for wood, as is commonly practised on old vines. During the summer you must constantly go over your vines, and displace all weak latteral shoots as they are produced, and carefully keep the ground clear from weeds, as was before directed, that the shoots may ripen well, which is a material thing to be observed in most sorts of fruit-trees, but especially in *vines,* which seldom produce any fruit from immature branches. These things, being duly observed, are all that is necessary in

in the management of young vines; I shall, therefore, proceed to lay down rules for the government of grown vines, which I shall do as briefly as possible:

First, Vines rarely produce any bearing shoots from wood that is more than one year old; therefore great care should be taken to have such wood in every part of the the trees; for the fruit are always produced upon shoots which come out from the buds of the last year's wood, so that is always upon the same year's shoots, the method commonly practised by the gardeners in England is, to shorten the branches of the former year's growth, down to three or four eyes at the time of pruning; though there are some persons, who leave these shoots four or five eyes long, and affirm, that by this practice they obtain a greater quantity of fruit; but this is very wrong, since it is impossible, that one root can nourish forty or fifty bunches of grapes, so well as it can ten or twelve, so that what is gotten in number, is lost in their magnitude; besides the greater quantity of fruit there is left on *vines*, the later they are ripened, and their juice is not so rich, and this is well known in the *Wine countries*, where there are laws enacted to direct the quantity of shoots, and the number of eyes that that those are to have upon each root, least, by overbearing them, they not only exhaust and weaken the roots, but thereby render the juice weak, and so destroy the reputation of their wines. Wherefore the best method is to leave the bearing shoots about four eyes in length, (because the lowermost never produce) and three buds are sufficient, for each of these will produce two or three bunches, which is a sufficient quantity. These shoots must be laid in about eighteen inches asunder; for if they are closer, when the side-shoots are produced, there will not be room enough to train them in against the wall, which should always be observed; and as their leaves are very large, so the branches should be left at a proportionable distance, that they may not croud or shade each other.

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In pruning you should always observe to make the cut just above an eye, sloping it backwards from it, that if it should bleed, the sap might not flow upon the bud; and where there is an opportunity of cutting down some young shoots to two eyes, in order to produce vigorous shoots for the next year's bearing; and this reserving of new wood is what the vignerons abroad always practise in their vineyards. The best season for *pruning* of *vines* is the end of September, or the beginning of October, for the reasons before laid down. The latter end of April, or the beginning of May, when the vines begin to shoot, you must carefully look them over, rubbing off all small buds which may come from the old wood, which only produce weak dangling branches; as also when two shoots are produced from the same bud, the weakest of them should be displaced, which will cause the others to be stronger, and the sooner this is done, the better it is for the *vines*.

In the middle of May, you must go over them again, rubbing off all the dangling shoots as before; and at the same time you must nail up all the strong branches, so that they may not hang from the wall; for if their shoots hang down, their leaves will be turned the wrong way; which, when the shoots are afterwards nailed upright, will have the back surface upward; and until the leaves are turned again, and have taken their right direction, the fruit will not thrive; so that the not observing this management will cause the grapes to be a fortnight later before they ripen; besides, by suffering the fruit to hang from the wall, and shaded with the closeness of the branches, it is greatly retarded in its growth; therefore, during the growing season, you should constantly look over the *vines*, displacing all dangling branches and wild wood, and fasten up the other shoots regularly to the wall, as they are extended in length; and towards the latter end of May you should stop the bearing branches, which will strengthen the fruit, provided you always leave their eyes above the branches; for if you stop them too soon it will injure the fruit, by taking away that part of the

the branches which is necessary to attract the nourishment to the fruit, as also to perspire off the crudities of the sap, which is not proper for the fruits to receive.

But although I recommend the stopping those shoots which have fruit at this season, yet you should by no means stop those which are intended for bearing the next year, before the beginning of July, lest by stopping them too soon, you cause the eyes to shoot out strong lateral branches, whereby they will be greatly injured. These therefore should be trained upright against the wall until that time; when their tops may be nipped off, to give strength to the lower buds. During the *summer* season, you should be very careful to rub off all dangling branches, and train up the shoots regularly to the wall, which will greatly accelerate the growth of the fruit; and also admit the sun and air to them, which is absolutely necessary to ripen, and give the fruit a rich flavour; but you must never divest the branches of their leaves, as is the practice of some persons; for although the admitting of the sun is necessary to ripen them, yet if they are too much exposed thereto, their skins will be tough, and they will rarely ripen; besides, the leaves being absolutely necessary to nourish the fruit, by taking them off, the fruit is starved, and seldom comes to any size, as I have several times observed; therefore a great regard should be had to the summer management of the *vines*, where persons are desirous to have their fruit excellent, and duly ripened.

When the fruit are all gathered, you should prune the *vines*, whereby the litter of their leaves will be intirely removed at once, and the fruit will be the forwarder the succeeding year, as has been before observed. Having thus treated of the management of vines against walls, &c. I come next to the culture of such as are planted in vineyards; but as the number of those in England are small, and the experience of them not very great, I shall first subjoin an account of their planting and managing their *vineyards* in France and

and Italy, and then shall add some observations and experiments of my own.

The Manner of making Wine in CHAMPAIGN, *and how it may be propagated in other Provinces to bring it to Perfection.*

WINE is so delicate a liquor, and an aliment so proper to give strength, and to preserve health, if used with moderation, that one may very well wonder, that, in most of the provinces of France, they make it with so much negligence in all those places where it might be excellent. The *Champenois* are exempted from this reproach, and, whether it be from a delicacy of taste, or a desire of making an advantage of their wines, or a facility in rendering them better, they have been always more industrious to make them more exquisite than those of the other provinces of the kingdom. *

It is true, it is scarce sixty years since they have studied to make the pale wine, which is very near white; but before, their red wine was made with more care and neatness than any other of the wines of the kingdom. I shall not enter upon the ancient or modern dispute, as to the preference between the wines of Champaign and Burgundy; I shall content myself with taking notice of all that the people of Champaign have invented, to give the fineness and agreeableness to their wines; and by the observations that may be made therefrom, it will be easy to see, that the same may be imitated in other provinces, so as to come pretty near that lightness and exquisiteness.

* It is this exquisiteness that prevents their being imitated or adulterated.

ness. If these essays will give hopes of success for the future, the wines of those provinces might be brought to perfection by degrees, where they might be delicious, and where they are but too common, because they have never studied to give them that fineness.

Culture. In order to have the wines excellent, the vines ought to be well exposed to the sun, especially to the south, and also on the decline, or in the manner of a little hill, rather than on a plain. Vines should be well chosen, and should be such as generally produce none but small black grapes; the bottom of the soil should be good, a little stony, and not naturally moist. The grain of the soil of Champaign is very fine, and has a singular quality, that is not found in the other provinces.

As these kinds of lands are light, there is occasion to dung them from time to time, and to lay on new earth; but the dunging ought to be very sparingly done; too much of it will render the wine soft and insipid, and apt to be ropy. It ought to be commonly cow-dung, because that is not so hot as horse-dung; in strong lands it may be mingled with horse-dung and sheep-dung, provided that the horse-dung be so rotten that it may be reduced to a powder, and that there be but one-half as much as of cow-dung, otherwise it would burn the vines. Let it be laid in a trench or pit, and mix one layer of dung and another of new earth, and let it lie and rot during a whole winter; and towards the month of February take from thence half a basket for every vine, especially for each new plant, to help them to push forth. It is sufficient for a vineyard to be dunged once in eight or ten years. After the dung has been carried, the vines ought to be opened round about, and a little trench to be made round the foot of the vine, and to be buried there at a proper time. Divers persons leave it there many weeks before they bury it, but this is not the best way; for the air, the cold, or the sun, will be apt to dissipate the most subtile substance of it; but when it is neither too

cold nor too hot, it may be left open eight or ten days, to exhale its ill-savour, especially the dung of sheep.

Dressing. They give to a vine four ordinary dressings, according to their seasons; but it is proper to take notice of one thing, which is scarcely observed in Champaign, which is, that they cut their vines in the month of February, and even in January; instead of which, they ought never to begin to cut them till after the 14th of February, when they are cut before, they push out sooner, and are exposed to injury, and are sometimes killed if any hoar-frosts come presently after they have been cut; but when they stay till after the 14th of the month of February, there is no danger of their being injured by the frosts. The covetousness of the vignerons leads them to undertake the cultivation of more vines than they well can manage; and for this reason they cut their vines in January, which does an infinite deal of injury to them, and to the greatest part of the plants, which they are sensible of for many years.

In Champaign they cultivate two sorts of vines, which they call the high vines and the low vines. The high vines are such as they leave to grow in those places that are less fine, to the height of four or five feet; the low vines are those which they do not suffer to grow above three feet high; these they inter, or ravale, according to the country term, every year, so as to leave but a little of the end to appear, which is repeated annually.

The *high vines* produce plentifully, and give often seven or eight pieces of wine an arpent; the *low vines* produce but little; but then the wine is much more delicate; they often do not give above two pieces of wine an arpent, oftentimes less; seldom three, but much seldomer four.

In order that the wine may be the finer, all the vines which give the white grapes must be taken away, and those also that give the large black grapes; but they need not pluck these up, but graft them. Sometimes these grafts will not succeed, which being observed, they must be plucked up, and new ones, that have a root, set in their room, which they chuse out of the nurseries, that are common in the country. They ordinarily purchase these plants for a pistole a thousand. A private man, that has a great many vines, may make himself nurseries.

These plants that have a root are put into the earth, in the middle of a great hole, about a foot deep, which they make with a stake, or strait mattock, or pick-axe; and these produce sooner than the others, which have no root; a plant that has a root begins to give wine, a little, the third year, indifferently the fourth and fifth, and in abundance in the following years, and so for above sixty years. These new plants ought to be dunged the second year, and in the sixth year, and afterwards in the eighth and tenth year, as other vines.

It will be to the purpose, every year, to pull up part of the old plants, which take up room, and produce little or nothing, and by this means a vineyard will be constantly renewed, as one may say, and in a perfect good condition.

Caution. *When there are dews* or humidities in May, June and September, the vignerons must not be suffered to enter the vineyards in a morning; for the dews of these months are commonly very cold, if the sun do not draw them up; which burns the leaves of the vines which are touched, before they are drawn up. It is very essential not to enter the vineyards at the time when there is hoar-frost, or showers attended with frost; for this will certainly kill the vines. The vineyards must be weeded now and then, and if there be any beetles, which are pernicious animals to plants, they must be picked off, and

 put

put into sacks, and burnt at some distance from the vineyard, and the ashes buried.

Lopping. About the end of June, and also of the month of May, according as the vineyard is advanced, it is necessary to cut off the end of each twig, that the plant may grow no more in height, and that it may convey all its nourishment to the grapes ; it is enough, if it had two feet and an half, or three at most, above the ground ; all the rest is to be cut off, as must also the tops or ends of the young shoots, which proceed from the bottom or sides of the stocks. This ought to be done twice, thrice or four times in a summer, according as the vines put forth, more or less, in certain years.

Propping. In the season, they put a prop to every vine, to support it ; they ought to be chosen, as much as may be, of oak, and to procure them of the quarter or heart thereof, if you are willing to go to the charge of it. These will last above twenty years, and when they are once made sharp, they will aways keep so ; for when they begin to rot, they perish equally throughout, and remain always pointed. The others last scarce four or five years ; and the master must have an eye over the servants when they sharpen them yearly, that they do not cut them too much, and make them too short, and that they do not break a great many that might serve ; for oftentimes in cutting off that which is rotted, they cut off two or three inches of that which is sound, or that which is good, which prejudices it as to duration. They call these props foot props.

THE VINTAGE.

When a vineyard has been cultivated and managed for the year, after the accustomed manner, and the vintage-time approaches, when they have made choice of and prepared new casks that will contain

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it; and when the press has been washed, cleaned, and greased, you must be very watchful to find when the grapes are too ripe, for then the wine will not be sufficiently strong; if they are too green, it will be hard,more difficult, and longer before it is fit to be drank.

In the provinces of Languedoc and Provence, the grapes have two large stones; they have too many white ones; they suffer them to be too ripe, which gives them over-much liquor; they let their stocks grow to be old, and do not renew them often enough; they are planted, for the most part, upon too good bottoms, or too moist, and have not an aspect of the sun good enough.

To make an excellent wine of the first pressing, having first well examined the maturity of the grapes; you ought to endeavour not to gather them but on days that are very dewy, and in hot years, after a little rain, when you can be so happy as to have it. As the grapes are not ripe till towards the end of September, and sometimes the beginning of October, dew is rarely wanting in vintage-time. This dew gives the grapes a flour or farina on the outsides, which they call Azur, and inwardly a freshness, which causes that it does not heat very easily, and that the wine is not coloured.

It is very lucky, if there chances not to be a misty day in dry years, which now and then happens; the wine is not only thence more white and delicate, but the quantity is by much the greater, being augmented by near one-fourth part; a private person, who has but twelve pieces of wine, in gathering his vintage in a morning which has the sun without dew, will have sixteen or seventeen, if the morning be misty; and fourteen or fifteen, if it has no mist, but yet has a good dew; the reason of this is, that the dew, and, above all, the mist, renders the grapes tender, so that the whole, in a manner, turns into wine.

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The wine produced from the grapes that have not be n warmed the moment they are cut, will still remain much paler; whereas when the sun has warmed the substance of the grape, it will become more red by the motion of the parts; but the quantity will be lessened, either by reason of transpiration, or because the rind has been thickened and hardened by the sun, whereby it yields its juice with more difficulty. This, experience hath taught, is of so much the more concern, by how much the more certain it is. They agree in Champaign, that the wine, which they call River Wine, is ordinarily paler than that of the Mountain; but they do not give the reason of it. I believe the vineyards that are near a river enjoy all the night a fresh air, which the river exhales; whereas the vineyards of mountains do not respire, during the night, that warmth which proceeds from the exhalations of the earth, and it is that which makes the colour, more or less; also when the years are very hot, they cannot, either to those of the river or of the mountains, warrant the colour; and when the years are cold, neither the wines of the mountains nor those of the rivers are coloured; the reason is the same, because the wines of the rivers are more soft, forward, and sooner fit for drinking, than the others that are harder, more heady, and later fit; they call the wines of the river, Auville, Aye, Epernay, Cumires, Pierry, as Fluery, Damery, Vanteuil, and others; but Varzenay, Sillery, St. Thierry, Mailly, Rilly, and some others, are of the mountains; these latter wines keep as well as the first, and, in good years, they keep equally well in bottles for five or six years.

Gathering. They gather not all the grapes without distinction, neither at all hours in the day, but they chuse the ripest and bluest; those are the best, and make the most exquisite wine, whose berries grow not too close together, but are a little separated, whereby they ripen perfectly well; for those that are close joined together never ripen thoroughly; they cut them with a small crooked knife, with as much neatness, and as little of the tail, as they can, and they lay them very

very gently in the baskets, so as not to bruise one grape. With thirty grape-gatherers they will run over a vineyard of thirty arpents in three or four hours, to make one first pressing of ten or twelve pieces. In wet years, great care should be taken not to put any grape that is spoiled into the basket; and at all times you must be very careful to cut away the rotten grapes, or those that are bruised, or quite dried up; but you must never stone them.

They begin the gathering of grapes half an hour after sun-rising; if the sun is not clouded, and it is a little hot, about nine or ten o'clock they leave off gathering, and make their sac, which is one of the first pressing; because, after this hour, the grape being warm the wine will be of a red colour, or teint, and will be a long while very heady. Upon these occasions they get a great number of gatherers, to be able to make up a sac for a pressing in two or three hours; if it be over-cast, they may gather the whole day, because the grape will preserve its freshness upon the stock. The gatherers and the pressers ought to take great care that the grapes be neither foul nor heated when they are pressed; and also, that the grapes have their flour under the press.

Pressing and Fermenting. When the press is near the vineyard, it is easy to prevent the wine from having a colour, because the grapes may be carried gently and neatly in a little time; but when they are two or three leagues off, they being obliged to send the grapes in casks and in carts to press them as soon as may be, it is hardly to be avoided but that the wines will be coloured, except in very moist and cold years. This is a certain principle, that when the grapes are cut, the sooner they are pressed, the more pale and delicate is the wine; for how much the more the wine stands upon the marc, the redder it is, so that it is of great importance to hasten the gathering of grapes, and pressing of them.

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The presses of Champaign are very commodious; the particular persons that have many vineyards of their own, have them in or near the same vineyards; in some places the presses are called bannaux, which are of different sizes and fashions. An exact description of these several presses will be inserted in the article of Wines. The small ones are about seven feet and a quarter; the middle ones about ten or twelve; the large ones fifteen or eighteen; the least, which they call etiquets, cost seven or eight hundred livres; the second, which they call a cage, or a teissons, about two thousand franks; the large ones, a thousand crowns, and sometimes more, according as the wood is cheaper or dearer in certain places; in Languedoc and Provence, where wood is scarce, these sort of presses cost a very great price, and but few persons are in circumstances to be at the charge of them.

When the grapes have been put under the press, or on the marc, they put three great rods or poles, of ten or twelve inches round, upon them, one at either end in length, and the third in the middle on the same side; these extremities serve to describe the lines which they ought to follow with their cutting-shovels, in cutting the marc. The substance squeezed on two sides, after the cut is made, they lay upon these poles; and on the grapes, planks of the size of the press, and upon these planks half-beams of eight or nine inches square, which they call moyaux, at a foot distance one from the other; they put four or five rows of these moyaux across one upon another, which elevates it with the bag about four or five feet; and they let down upon the whole three or four great beams of an immense weight, which are placed in the middle of the press across, and borne up at one end by two strong side-beams, which are sunk fifteen or twenty feet into the ground, and which are fastened to the bases which cross them; at the other end there is a cage, as they call it, or a wheel with a screw, to raise or lower these great beams upon the moyaux, and thus to press the grapes; then they presently raise, by the means of a screw, the end of the trees on the side of the wheel, or of the cage,

cage, which lowers the other end of the cheeks, or side-beams; then they drive with a great mallet two or four great wooden quoins between the notch which is in the side-beams, or cheeks, and these beams are also lowered to keep them in their position, and to prevent them from rising; and after this they lower the other end by the aid of the screw, which serves also to raise it.

They use in these presses large steel-shovels, about a foot in breadth, and one and an half in depth, very heavy and sharp at the bottom, to cut the marc of the grapes easily at the four sides.

The first time they lower the great beams upon the grapes, they call the wine that runs out, the Wine of Goute, because it is the finest and most exquisite in the grape; this wine is very thin, and has not body enough; they call this first pressing l'Abaissement; this must be done with a great deal of dexterity and briskness, that the beams may be raised immediately, to send back to the middle instantly the grapes which are slipped to the sides all round about, to press them briskly the second or third time. They call these two other lowerings of the beams, the first and second cutting; they must be done in less than an hour, if you would have the wine very pale; because time is not to be given to the grapes to heat, nor the liquor to remain upon the marc.

They ordinarily mingle the wine of the abaissment, or lowering, with that of the first and second cut; and sometimes, but very rarely, with that of the third, according as the years are more or less hot, and thence they call a wine of the first pressing fine. Some preserve one or two carteaux of the first taste, which is that of the lowering, by itself; but it is too small or thin, and has not a sufficient body for wine. There are some skilful persons who pretend, that the lowerings of the wines ought not to be mixed but with those of the first cut, because that is much more delicate than that of the second and

 third;

third; and that, besides, there is time enough to mingle them afterwards, if they are found to be too fine, and pale enough; and the rather, because there is no remedy if it be done at the first.

At every cut they raise the greater beams, and they take away all the moyaux with the planks, and the rods that are immediately upon the grapes, or upon the marc; with these steel cutting-shovels they cut the marc on four sides, and they cast down with their wooden shovels that which is cut, and they spread it even all over the square, to the end that it may not disperse so easily; that is to say, in those presses which they call etiquets; they take care, that the wheel which is upon the middle, may be made to bear, especially upon the rammer, over all the breadth, in such manner that the bag may be equal. Instead of the presses, (a cage) or teissons, as the beams bear more upon the side of the wheel, than on the sides of the corners, there must needs be more of the marc when the bag is placed sloping toward the wheel, than towards the side of the quoins, as will be easily comprehended by viewing the descriptions of the different presses. It is also to be observed, that every time they cut the grapes or the marc, they tie up the bag, because it has always a certain elevation in such sort, that it is one-third less at the end than at the beginning.

The second cut is more plentiful than the lowering and the first, because the grapes begin to be well bruised, and they do not slip so much on the sides. The wine strains from the press into a puncheon, having the head staved out, or some other large vessel prepared for the purpose, and sunk into the ground on the foreside to receive it; it appears to be drawn a little upon the red, but it loses this little of its colour according as it is boiling, and as it clarifies itself in the tun; and it remains perfectly white, especially when they have pressed the two first cuts with much dispatch; but principally when they have gathered the grapes during the dew, or in a cloudy day Although these

these wines are white, they call them grey, because they are made only of black grapes.

If the year be hot, and the wine of the third cut has a colour, it must be mingled, not with that of the foregoing, but with that of the fourth, and sometimes, though but very rarely, with that of the fifth. They are not in so much haste for these cuts as for the first; they make an interval of a good half hour between the one and the other; the wine that comes thence has more of colour than this, which they call the Partridge's eye; or the wine of the cut; it is a strong wine, pleasant, fine, good for ordinary wine, but is better when it is old.

When the wine of the fourth cut is too deep, they do not mingle it with wine of the cut, but they observe to mingle it with wine of the fifth, sixth, or seventh cut, which they call *wine of the press*, which is too red, pretty hard, but fit for household-drinking; but when they are not in haste, they leave an interval of an hour and an half between every one of the three last cuts; as much to give time to the wine to strain insensibly, as to give the pressers time to sleep, or to rest themselves; for the fatigue is very great, they being obliged to carry it on night and day for about three weeks. The pressers of Champaign press the grapes so hard, that after they have done, the marc is as hard as a stone; they put this marc into old casks, with the heads out; and they sell it to people, who draw from it an Aqua Vitæ of a very bad taste, which they call the Aqua Vitæ of Axine; but it is good for a great many purposes. Those who have many vineyards also make two, three or four first pressings of fine wine, by choosing always the most delicate and ripest grapes for their firsts; these are always much superior the one to the other for goodness and for price; so that if the wine of one of the first pressings sells for six hundred livres a cuvee, that of the second will not sell for above four hundred and fifty, and that of the third two hundred and fifty, although all the wines are of one and the same vineyard.

In every first pressing there are ordinarily two-thirds of fine wine, one-half third of the wine of the cut, and one-half third of the wine of the press; thus one cuvee of five or six pieces of wine will consist of nine or ten of fine, three or four of taille, and two or three of the press. Of the common black grapes, which remain after one second or third cuvee, they make one with those that are not very ripe, and which they call verderons; they make of the whole a wine pretty high-coloured, which they sell to the country-people, or that serves for their domestics; they also leave these grapes two whole days in a great tub before they press them, to the end that the wine may be redder; and they mingle all that comes from the different tailles of this vintage. The white grapes do not come into this cuvee; they leave them upon the stock till towards All Saint's Day, or sometimes till towards the eighth or tenth of November, at which time the mornings are cold, to make of it a vin-bourra, as they call it, (*i. e,* a new and sweet white wine that has not worked) which they sell while it is quite hot. This wine is still the better when the grapes have borne the white frosts of October and November, or at least very cold mornings. A little rottenness in these grapes does no harm; you need only to take care to give the wine leave to throw out the filth by the ferment, and purify. This white wine may be mingled with the wine of the taille, if you will, if you have not an opportunity of selling it presently after it is fermented. This makes a very good wine to drink, is pretty pale, and has a good body.

All these fine wines ought to be put into new casks, as also should those of the taille; but the red wines, the green, and those of the press, may be put into old casks, but they ought to be good ones. You must never do the tuns over with brimstone; you should only wash them in common water, a little while before they are filled, and give them time to drain well; some handfuls of flowers, or peach-leaves, may be mingled with the water; and they pretend that this will do the wine good. In Champaign they rarely put their wine in any thing but

but pieces (carteux) and cades. The river measure is different from that of the mountains; the pieces of the river contain about two hundred and ten Paris pints, (a Paris pint is equal to an English quart) the carteau an hundred and ten; the pieces of the mountains contain about two hundred and forty pints, at the best two hundred and thirty, Paris measure, and the carteau an hundred and fifteen, or an hundred and twenty. They mark regularly, with chalk, every piece, and every carteau, which denotes the first, second, or third cuvee; the wine of the cutting of the press, the white wine, and the green; they also write the name of the vineyard from whence the grapes came.

Some few years since, some private persons in Champaign have attempted to make wine as *red* as that of *Burgundy*; and they have succeeded pretty well as to the colour; but, in my opinion, these sorts of wines do not come up to those of Burgundy, in that they are not so soft and agreeable to the palate; nevertheless many persons call for these wines; and some esteem them the best. And as those grey wines are a little fallen, there was made the last year a great deal of red in Champaign. These wines do well for Flanders, where they are frequently sold for those of Burgundy. Of all these wines there are none better for health, nor more agreeable to the palate, than the grey wine of Champaign, of the colour of a partridge's eye, or the wines of the two first tailles of a first pressing, in pretty hot years. This wine has a body, a tartness, a headiness, a balsamicness, an aromatic perfume, a quickness, and delicateness, that exceeds all the most exquisite wines of Burgundy. And that which should engage one to drink it is its lightness, which makes it strain and pass quicker through the body than any other wine in the kingdom. It is a mistake, to be of opinion, that the wines of Champaign give the gout. I have scarce ever seen one gouty person in the whole province; and there need be no better proof.

To make good wine in Champaign, the black grapes ought to be gathered in the heat of the day; care is to be taken to chuse them well, and not to mingle with them the grapes of the vine-arbour, nor the green ones, or those that are partly rotten; to let them lie two days in one tub, where the liquor grows red by the heat that it contracts there; some hours before it is put into the press it ought to be trampled with the feet, and the juice be mingled with the marc; without this the wine will not be of a sufficient redness. If it be let stand more than two days in the tub, it will taste too much of the stone. If it be mingled with the wine of the press, it will be too thick, too hard, and too unpleasant.

If they would continue to make good red wine in Champaign, they must trample the grapes as in Burgundy, and leave them for three, four, or five days, in one tub; but as the red wine of Champaign never equals the goodness of that of Burgundy, the reputation of the grey wines will sink in a short time, and the public will bring an infinite detriment to the province.

The wine of the first pressing being finished, and the vessels marked, they set them in a row in a cellar or court-yard. Those who have a great deal of wine, and are good œconomists, take great care to gather the scum that comes out of every vessel, while the wines ferment, by the means of a kind of tin funnel, made bending downwards, which lets the scum fall into a wooden bowl, which is placed between two casks; they afterwards put these scums into the wines of the press; but, nevertheless, there are but few that use this piece of œconomy.

They let these grey wines stand to ferment in the casks ten or twelve days; because these wines throw out their ferment so much the more or less slowly, by how much they have more or less warmth, or as the years are more or less hot. After the wine has done ferment-

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ing, they stop up the vessels at the great bung-hole, and leave on the side forward an opening, about the bigness of a French farthing, by which one may put in his finger; this they call la broquèleur; and they stop this up ten or twelve days after, with a wooden peg of about two inches long, for the more readily taking it out, and putting it in. All the while the wines are fermenting, the vessels are to be kept almost full, to give them an opportunity of casting out all that is impure. In order for this, they must be filled up, for three days, within two fingers of the bung; after they have been bunged up, they must be filled up every eighth day, at the little hole, for the space of two or three weeks more; and after that, once a day, for fifteen days, during one month or two; and after that, once every two months, as long as the wine remains in the vault, if it be there for years. When the wines have not body enough, or are too green, as it often happens in moist cold years, and when they have too much liquor, as in hot and dry years, three weeks after the wines have been made, they must be rolled in the casks five or six turns, to mingle them with the lees; and this must be continued every eight days, for three or four weeks; this mingling of the lee with the wine being repeated, will strengthen it, soften it, ripen it, and render it more forward, and make it fit to drink in as short time as if it had been transported from one place to another. These wines must be let stand in the cellar till towards the tenth of April, when they carry them down into the vault; but as soon as it begins to be cold, they are to be carried up again into the cellar; it is of consequence to be observed, upon this subject, that the wines ought always to be in cool places, and never to suffer the heat. And as the vaults are cool in the summer, and warm in the winter, as soon as it begins to be hot, the wines must be carried down, whether they be in pieces or in bottles, into the vaults; and when it begins to be cold, they must be carried up into the cellar.

Racking. There has been nothing better invented, and more useful, than the manner of drawing off wines. Certain experience convinces, that it is the lee that spoils wines; and that they are never better, nor more lively, than when they have been well drawn off, whether you would bottle it, or keep it in the pieces; it ought always to be drawn off out of one vessel into another, at least twice into another vessel well washed, leaving the lee in the former.

Fining. You should draw off the wines the first time towards the middle of December; the second, towards the middle of February; and to fine them in March or April, eight days, or thereabouts, before you bottle it. For every piece of wine you must have of isinglass, that is the whitest, of the weight of a crown of gold, weighing two deniers fifteen grains, or sixty-three grains.* They take so many times the weight of a crown of gold, as they have pieces of wine to draw off; they put this quantity of isinglass in one or two pints of the same wine in a bucket for a day or two, to give it time to dissolve; others put it in a glass or a pint of water, according to the quantity, in order to hasten its dissolving, which is always difficult to be done; some mix it in chopin, or a pint of spirit of wine, or excellent aqua vitæ. When the isinglass is grown soft, they handle it well to divide it and distribute it; then, when the parts begin to separate, they put in the bucket, or vessel, in which this dissolution is made, so many pints of wine as they have casks or pieces to draw off; then they handle the isinglass well again, and pass it through a strainer, the holes of which should be very small; they often pour in some of the same wine to dilute it well; and when there remains nothing in the strainer, they pass all the liquor over again through a linen cloth, and squeeze it very well; and afterwards they put one good pint or less into each cask, and half into each carteau. They stir the wine in the piece

* Our wine merchants use an ounce of isinglass for a pipe of wine, and dissolve it in sour wine;—the sourer the sooner it dissolves.

piece with a stick about the middle, without suffering the stick to go any lower. It is sufficient to stir the wine for the space of three or four minutes. A certain private person has contrived a quicker method of dissolving this isinglass; after it has steeped one day in water he melts it in a skillet upon the fire, and reduces it to a ball, like a bit of paste, and afterwards puts it into the wine, where it distributes itself with less difficulty. After what manner soever it be dissolved, care ought to be taken, not to put in too much liquor, and not to put more than a proportionable quantity of water or wine to that of the isinglass. The isinglass works its effect ordinarily in two or three days; though sometimes it does not clarify the wine in six or eight; but nevertheless you must wait till the wine is clear before you change the vessel. In the winter the seasons are oftentimes so improper for this, that there is a necessity of putting isinglass a second time into the piece, but then you must not put in more than the quantity before mentioned; but when it freezes, or the weather is clear and cold, the wine will clarify itself perfectly well, and in fewer days; it has a colour more lively and brilliant, than when it is fined and drawn off in faint moist weather. As soon as the wines are clear, they are to be drawn off, and the vessels changed. Four or five new casks are sufficient to draw off two or three hundred pieces of wine; for when they have emptied one piece, they take out the lee, and put it into the old casks, wash it, and it serves to draw off another into it.

They put together, into separate casks, all the remainders of the empty pieces; presently after they have emptied one, which they do in half an hour, they wash it with a bucket of water, let it stand to drain some moments, and then fill it with another that is to be drawn off. After the wine has been emptied out of one vessel into another the first time, they draw it off a second time, at the time we have before-mentoned; sometimes they are obliged to do it a third time, to give it a lively colour, if it has it not already; but four days before

they change the cask, they give it a frizure, as they call it, and put in it one-third part of ordinary isinglass.

The most experienced persons shift their fine wines out of one vessel into another, as often as they change its place, as well when they carry it down into the vault, as up into the cellar, according to the different seasons. I have known, when, in four years time, they have drawn it off twelve or thirteen times; and they pretend, that this is that which preserves and sustains the wine, and that it has been the finer and more delicate. Their opinion is, that the wine is continually forming a fine lee, which gives it the colour; and that to preserve it of a good white, it must be often shifted out of one vessel into another, if it be not put into bottles; and that there is no reason to fear that the wine will be weakened by this means, because, the oftener it is removed, the oftener you give it a new vigour; and the oftener it is drawn off, the more lively and brilliant is the colour.

Matching. And although I have said they should not brimstone their casks, they do not fail to use a match of brimstone the first time that they change their vessels; they mingle a piece of thick linen cloth in the melted brimstone, and they cut off a bit for each cask of fine wine, about the size of one's little finger, and one as large again for every piece of common wine; they light it, and put it under the bung of every piece that they empty, before that they have recourse to the bellows; according as the wine descends, it draws along with it a small scent of brimstone, which is not very strong, so as to make it perceivable, and that only leaves what will give it a liveliness of colour; the same may be done the second time when they change the cask, if it has not taken the scent the first time, otherwise it ought to be drawn off the second time without a match, to cause it to lose the scent of the brimstone, which it ought never to have.

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The wines that are thus clear and fine, keep well in the cask for two or three years, and hold their goodness in the vaults and cellars, but especially the mountain wines that have a good body; those of the river lose their quality in the wood, and they ought to be drank in the first or second year, or else they must be put into bottles. This wine will keep very well four, five, or six years in glass bottles.

Bottling. When they have a mind to draw off a piece of wine into bottles, they put a little siphon of metal into the cask, which is bent downwards to strain it into the bottle, under which there is a tube or bucket to catch the wine which shall run over. They stop up every bottle carefully with a good well-chosen cork that is not worm-eaten, but that is solid and close. These sorts of fine corks cost fifty or sixty sols an hundred. There cannot be too much care taken in the choosing corks, lest the wine spoil in some of the bottles, when the corks are defective; therefore great care should be taken in the choosing them, when you would draw off fine wines into bottles, whether it be for keeping, or to be sent abroad. When bottles are used that have been made use of before, they should be washed with leaden shot and a little water, to fetch off the filth that shall remain on the bottom of the bottles; but it is much better in the room of them, to use small nails, because they perfectly take off all that which sticks to the glass. When all the bottles, that suffice to empty one cask, are filled, they tie the mouth of the bottle over to the neck with a strong packthread; and if it be a fine wine, they commonly seal it with Spanish wax, that the wine may not be changed, nor the bottles, by the domestics; and some persons have their coats of arms made on the bottles, which does not enhance the price above thirty sols per cent. When all the bottles are well-stopped, tied down, and sealed, they ought to be set either in a vault or cellar, upon sand, two or three fingers depth, and laid sideways, leaning against one another; when they are set upright, they form a white flower upon the wine at the top, in the small empty space that is between the top of the

mouth of the bottle and the wine; for the bottles ought never to be filled up to the top, but there must be left a small empty space, of about half an inch, between the wine and the end of the cork. If this was not done, the wine would set a working in the different seasons of the year, and break a great number of bottles; and it does, notwithstanding, break a great many, in spite of all the caution that can be taken; and more especially when the wine has a great deal of heat, or is a little tart. In some years the wine grows ropy in the bottles, even in the vaults, so as to rope when it is poured out, as if it had oil, so that it cannot be drank. This is a malady that seizes the wine that has stood several months without being removed from one place to another; if it be set in the air it will remove more of its ropiness than it will if left in the vault; it will recover itself in eight days, if set in a very airy granary, better than it will oftentimes do in six months in a vault. When one is obliged to drink a ropy wine, if he shake the bottle strongly for the space of half a quarter of an hour, and then uncork it immediately after he has done shaking it, the bottle, being inclined a little on the side, will cast out presently half a glass of froth or scum, and the rest of the wine will be drinkable, whereas otherwise it would not be so.

Mantling. For about twenty years last passed, the gust of the French has been determined for a frothy wine; and this they used to love, as one may say, even to distraction. They have begun a little to come off from that for the three last years. Their sentiments are much divided as to the opinion of this kind of wine; some believe, that it proceeds from the force of the drugs that they put in it, which makes it froth so strongly; others attribute it to the tartness of the wines, because the greatest part that do froth are extremely tart; others attribute this effect to the moon, according to the times in which these wines are bottled. It is true, there are a great many wine-merchants, who, seeing the great fondness that there is for their frothy wines, oftentimes put in alum and spirit of wine

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to make it froth extremely; but it is certain, by experience, that the wine froths when it is any time bottled from the vintage to the month of May. There are some who pretend, that the nearer the vintage-time the wine is produced, when it is bottled, the more it froths. Many do not agree to this opinion, but nothing is more certain, than that there is no time in which the wine froths more, than about the end of the second quarter of the month of March, and this always happens towards the holy week. There does not need any artifice at all; one may always be sure to have wine perfectly frothy, when it is bottled from the tenth to the fifteenth of the month of March; of this there is such reiterated experience, that it cannot be doubted. It is good to know, that the wine does not froth presently after it is put in bottles; it must be at least six weeks, and sometimes six months, before it froths well. If it is to be transported, you must give it near a month of the vault, especially in summer, to recover its remove. But as wines (especially the mountain wines) are not ordinarily bottled in the holy week, because they are then too green, or have too much hardness, especially if the year has been cold and moist, or too much liquor expressed, if the year has been hot; the most sure and advantageous way to have exquisite wine, that is perfectly frothy, is not to bottle it till the rise of the sap of August. It is certain, by experience, that it froths excessively when it is bottled from the tenth to the fourteenth of August; and as it will then have lost the tartness or greenness of its liquor, one may be assured in bottles to have the ripest and most frothy wines. There has been another experiment tried, which is, not to bottle the mountain wine till the holy week of the second year, that is eighteen months after the vintage; and it has been found, that it froths sufficiently, but less by half than that which has been bottled in the rising of the sap of March the year before. It is not believed, that the river wine, which has a less body than that of the mountains, can froth so much in the second year. When one would have wine that will not froth at all, it should be bottled in October or November,

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the year after the vintage; if it be bottled in June or July, it will froth slightly, though but a little, if any thing at all.

To find in the wine of Champagne all the merit that it ought to have, it should be taken out of the vault not abve half a quarter of an hour before it is drank, and it must be put into a bucket, with two or three pounds of ice; the cork should be opened, and put in again lightly; which if it be not done, the wine will break the bottle, or will not grow cool, if it were not unstopped; and it would evaporate itself, if it remains quite open. When the bottle has been half a quarter of an hour in this ice, it must be taken out, because the ice would otherwise chill it too much, and make it lose its briskness. This wine will be excellently good, and of a delicious flavour, when it has been a little effected by the ice; but great care must be used, that it may not be either too much or too little.

As these wines, especially those of the same year, work continually in the vaults and cellars, and still more in bottles than in the piece, according to the different seasons, and the divers impressions of the air, it ought not to be surprising, if the same wine, especially the new, oftentimes appears different in taste. We find a wine potable in January and February, which will seem hard in March and April, because of the rising of the sap, which agitates it more; the same wine in June and July will appear intirely soft, and in August and September we shall find it hard again, which one shall not be able to perceive any thing of during the preceding months, because the rising of the sap in August will put the parts in a great motion. Motion will have this effect on the river wines of the year; but oftentimes the wine of two years from the mountains will appear more mellow, more or less exquisite, more or less forward, according to the different motions it has received by the different impressions of the air, which will vary more sensibly in the different seasons of the year. There ought to be a very great attention to keep the wine continually in cool places;

nothing

nothing does it more hurt than heat; it is therefore of the greatest importance to have good cellars, and excellent vaults. No part of the world has so good vaults as those in Champagne, which is the reason it is so difficult to find any where else so good wines as those of this Province. Those who would lay up a stock of wine, and are able to keep it two or three years, or whose business it is to send it into other far distant provinces, or to foreign countries, ought to chuse the mountain wine; for as it has more body, it will better bear transportation than those of the river; and besides, the English, the Flemings, the Dutch, the Danes, and the Swedes, desire these strong wines, that can bear the transportation, and hold good for two or three years, which the river wines will not do.

The best Wines. The most noble river wines are those of Auvillers, Ay, Epernay, Pierry, Cumieres; those of the mountain are, of Sillery, Verzenay, Taissy, Mailly; and above all, those of St. Thierry have the most reputation. The last has for a long time had the greatest name, and been the most called for; and one may venture to say, that it comes nothing behind the best wines of Champagne. By all the observations which have been made on what is practised in this province, in cultivating and ordering the vines, and in fining off the wines, in bottling and carrying them up and down into the cellars and vaults, and from vaults to cellars, it will be found, that even persons of good taste, in the provinces of Burdundy, Berry, Landuedoc, and Provence, who are yet very curious and delicate in making wines, especially for their own tables, know not so well how to bring it to perfection, as those who are accustomed to make it in this province; for though their wines have not the tartness of those of Champagne, yet they are able to make them more clear, fine, and light. They might therefore try if they would not be preserved better in drawing them off from the lee, than in letting them lie on it, according to their usual custom, which some are of opinion is absolutely wrong. They should choose and pick, in the fresh of the morning, their finest black

black grapes, and those whose berries adhere the least together, because they are the ripest; and they should observe to leave as little stalk to them as may be; and with regard to pressing, which they are usually faulty in, they should immediately, as soon as carried, trample every load of grapes successively as they are brought in; and, collecting the first, must put it in new casks of a less size; and when they have finished treading the remainder of each carriage, they should put them into the common vats; but let them not remain there so many days as they are generally used to do, that so their common wines may be thinner, and less strong. By this management, they might make four, five, or six pieces of fine wine, more or less, according as they shall find it good; and then they should take the same care, as has been said those of Champaign do; and if they would be content now with a less produce, they would have a far greater quantity the following years, and would be continually bringing it to a still greater perfection, as they improved more and more in experience. In those countries where they can conveniently have presses, they should make them. Their wines would be more delicate, more light, and less coloured, by this attention, and, with half the fining, would be better for transportation, in drawing them from the lee, and especially if they are put into bottles. There are some districts or cantons in the south provinces of the kingdom, where the earth is very fine, which would produce excellent wine; it would not, indeed, have the tartness as those of Champaign have, but then it would have another very pleasing flavour that those have not. All these observations which we have made, will be of great use to those persons who would improve their wines, or desire to drink delicious liquor. But such persons must remember, that they ought, above all this, to study to have good vaults, and those which are coolest in the summer, and warmest in the winter, are ever the best.

Nothing is so astonishing as the indifference there is in the remote provinces, where wine is so abundant, both in the culture of the vineyards,

yards, and the choice of their vines, as also in the manner of making, and the management of the wines. The want of presses ought not to be allowed as a just excuse for their not making their wines entirely white; but of this hereafter.

They practice nothing in Champaign, which may not be perfectly imitated in other places; the drawing off the wines, the manner of fining them, and putting them in bottles, &c. is all equally possible, and also easy. Many persons might enrich themselves, if they would set themselves about it, with the help of these observations, and of those they might make themselves, to bring their wines to perfection; and instead of selling them for one or two sols per pot, as they ordinarily do, they may sell them for upwards of eight or ten. They would have the satisfaction of augmenting their income, and see their wines sought after; and they would be able to sell them not only at home, but also to transport them into foreign countries, because their situation is more favourable to send them by sea than that of the Champanois, who are obliged to transport theirs upon waggons, and by rivers, into Germany, and the farthest parts of the north.

BURGUNDY WINE.

The town of Beaune is the centre of Upper Burgundy; it is situate in a territory the most fertile and serene in France; it is all round encompassed with cities, among which is Autun, the ancient capital of the Gauls; Dijon, the capital of the Duchy of Bourgogne; Nuis, St. Jean de Laune, Verdun, Seuree, or Bellegarde; Chalons, on the Saone, Arnay le Duc, Sanlieu, Flavigny, and Semeur. Beaune is placed almost in the middle of these towns, which are not above

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eight, nine, twelve, twenty-one, or twenty-four miles distant at the farthest, to be, as it were, a nurse to them all, in distributing plentifully amongst them the liquors which it produces.

The hills of Upper Burgundy which produce the wine, the only wine which one can or ought to call Burgundy wine, do not extend farther than from Dijon to Chalons upon the Soane; yet we ought not to reckon these vineyards to be in perfection but from *Chambertin* to Chagni, about twenty-four miles in extent; for the vines in Dijon and Chalons do not enjoy those climates which produce those wines which are fit to be transported into Great Britain, the circles of the Empire, and the Low Countries, as those which are confined within the limits that I shall mention as exactly as I can, without being apprehensive of passing under any censure upon this account. The same row of hills in the same situation, and having the same aspect of the sun, extends itself almost as far as Lyons, and all those little mountains are wholly covered with vines; but the lands are less fine, and less light, at Chalons, are heavier at Tornus, and coarser at Macon. This alters the form of the productions of these little hillocks, which, notwithstanding they have the same arrangement, and the same situation, produce very different liquors.

Vintage. A month before the vintage, the magistrates of Beaune, accompanied with many experienced judges, and persons of probity, make three visits to examine the maturity of the grapes; and at the third visit and examination they decide the day of gathering the vintage. No private person dares to cut in his own vineyard one single basket of grapes, upon pain of confiscation, and a considerable fine; for if it were permitted to each particular person to gather his vintage according to his own fancy, and his particular opinion, and according to his taste, there would be wines too green sent abroad into other countries, to the dishonour of Burgundy, and to the discredit of the wines. And also for fear that any vapour should spread itself over the

the vineyards, for fifteen days before the vintage, they take care not to burn any straw or hemp-stalks in the streets, lest the smoke should give any bad taste to the grapes. The grapes being come to maturity, the magistrates give notice a few days before by a trumpet to the town, of the time they have appointed and fixed for gathering the vintage. Volnet begins first, a day before Pomard, and afterwards all the little hills gather their vintage indifferently; for after the town of Beaune has gathered their vintage one single day, the vintage is opened for all the other vineyards on the side of Burgundy. It will be seen by and by why Beaune decides the vintage of Volnet and Pomard. It will scarce be believed, that all the hills from Chamberry to Chagny should have their vintage gathered in the space of four or five days; and also it is scarce credible, what a vast number of mountaineers from every part come to labour in this work. They gather the vintage, perhaps, (and my conjecture is founded upon more than twenty-five vintages, which I have seen made) more than two thousand [queues] tuns of wine upon these hills; and the queue, which is always divided into two puncheons, sometimes into four feuillettes, and very rarely into eight cabillons, contains five hundred bottles of wine, or, to speak more exactly, four hundred and forty pints, Paris measure. It will be proper here to observe, that in this great extent, the vineyards produce but one kind of grapes, which they call noirons; the berries of which are black when they are ripe, and quite round. The plain and the back-sides produce only a sort of grape of which the berries are bigger and a little longer, which they call gamet.

Pressing and Fermenting. Those who would make excellent wines never cut the grapes till after the sun has dried up the dew which has fallen in the night-time; for this moistness, although it be a rarefied air, cools the grapes, which, being cast into the first vat, suspends, and oftentimes hinders, the fermentation. Those covetous persons that are more desirous of the quantity than the quality, use not these precautions; but, on the other hand, those who would

make excellent wines, do not put into the same vat any grapes but those of the same vines; but almost all the particular persons who have an hundred perches of vineyard in different cantons, mingle the grapes the one with the other, because the strong helps the weak, and the good mends that which is worse; and, in a word, that they make the vat the larger. The choice of the cantons from whence the wine is produced, depends on the discernment that the courtiers or commissioners ought to have, when they taste the wines that they would send into other countries, and that which the English gentlemen ought to recommend to their commissioners who furnish them with wine for their drinking. The grapes being put into the fermenting vat, throw up a great scum, which, by the agitation, make to the ears a tremulous noise, and spread abroad such a scent, that is capable of intoxicating, and perfumes the houses, and spreads itself all over the town. They do not let the grapes lie still in the vat; they stir them and disturb them; the labourers trample them briskly three different times, for the space of two hours each time. And to give a clear idea of the manner of treating the grapes in the vat, as soon as they begin to ferment in the vat, they tread them for two hours at the least; six hours after, they tread them again for as long time as before; and six hours after that, they tread them the third time; and after that, they put them under the press. It must be observed, that the grapes of Volnet, of Pomard, and Beaune, being fermented in the vat in the field, cannot be let stand above twelve or eighteen hours there; those of Pomard a little less; those of Beaune so long, or a little longer, according to the delicateness of the ground, and the heat of the grapes; for there are vineyards behind the hills of Beaune, the grapes of which do not begin to ferment till after they have been eight or ten days in the vat. *Note further,* that to give a colour to the wine, this depends on the time, more or less, that it is left in the vat. As for example, the wines of Volnet have the colour of a partridge's eye. This is the cause they do not leave the grapes of this ground but a very little time in the vat; and if they should let them

them be there but a little longer than they ought, the wine would lose its delicacy, and would taste of the grape-stone or the stalks.

After the grapes have been, according to their quality, more or less time in the vat, and have been trodden, there swims over a liquor that they call surmou. They have casks of six-score pots, or half-hogsheads of sixty pots, ranged upon chantiers, or stillions for hogsheads, into which, by equal portions, they cast this first running; and afterwards they put the grapes that remain on the press, when the surmou has been drawn off; and when these have been well pressed, all the liquor that comes from them is equally distributed into those pieces where they have already put the unpressed wine; and then they open the press, and afterwards with a plainer they cut the pressed marc three or four fingers thickness round about, and put the parings in the middle, and afterwards press it again; then they cut it again, and press it the third time; and all the liquors of these different pressings are equally distributed into the tuns till they are full. Upon which it ought to be observed, that the unpressed wine is the most light, delicate, and least coloured liquor; that which comes off the first cut of the press the most racy; and that which comes from the second and third cut of the press is more hard, red, and green; so that these three sorts of qualities, being united, make a wine much better, more durable, and better coloured.

In the Tun. All these pieces or tuns being full, they leave the bung open, and the wine, in a fury, shakes and agitates itself in such a manner, that it sends all over the cellar fumes that will intoxicate, and which are in such motion, that a lighted candle being carried thither will be extinguished; and if this wine be put in an assay, and be shaken a little with the hand, and you stop the mouth with your thumb, the assay will break in a thousand pieces.

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In Burgundy, that which they call an assay, is a little round bottle, in length about three or four inches, and about two in circumference, which grows less all of a sudden at the top, in order to form a little neck having a little rim to receive the wine and the cork. The wine having cast its fire and scum off the casks, eight days after they fill them up again, and stop them up with a vine-leaf, which they spread over the bung; and lest the vapours of the wine should move this leaf out of its place, they lay a little stone upon it to keep it down; because, if they should put upon it a seal or a bung, the wine, not having air, would push the heads of the casks out. Five or six days after they seal it, and near the bung they bore a hole, and stop the hole which the gimlet has made in the tun with a little bit of round-pointed wood, which they call a faucet, which they take out from time to time to let the spirits evaporate; which precaution prevents the wine from bursting the vessel.

The first Article of the Wines of Primeur, *or the Forward Wines.*

We call that the wine of Primeur, which will not keep good more than one year, or that can be kept but a few months in the second year. The first wine of Primeur grows at Volnet, which is a village situated about three miles from Beaune, upon a descent of a mile in height at least, and two miles in length on the side which is exposed to the rising-sun; this village, as well as Pomard, have their dependence on the city of Beaune; since the citizens have been their lords, as I have said before, these two plots of vineyards have been obliged to receive the law of their vintages from the magistrates and sages named for this purpose. This hill produces the finest, most lively, and most delicate wine of Burgundy. The bunches of grapes of the vineyards of Volnet are very small, as well as the berries; the branches rise scarce above three feet high through the whole year; the grapes of

of it are so delicate, that they would not bear the vat more than twelve, sixteen, or eighteen hours; for if they be suffered to stand longer, they would take the taste of the stalk. This wine is in colour a little deeper than the eye of a partridge; it is full of fire, strong, light, it is almost all spirit; it is, in short, the most excellent of all Burgundy, which, by reason of its violence, is not traded in; but its intoxicating quality is soon dissipated. The duration of this wine is from one vintage to another, though it perishes at the beginning of the dog-days; after which it changes its colour, and is turned; but yet I doubt not but that it would keep longer in very cold vaults. The finest of their vats is drawn from a canton of vineyards, that is called Champan.

Pomard is the second plot of vineyards of the Primeur; it is situate between Volnet and Beaune, not quite so high as the first, and a little higher than Beaune. It produces a wine that has a little more body than the preceding, and it is of the colour of fire, and has a great deal of perfume and balsam; it will hold good some months longer than that of Volnet; it is more merchantable, and better for health; if it be kept above a year, it fattens, ropes, it wastes, and becomes of the colour of the skin of an onion. The best vat is that of Commaraine; that will sometimes keep eighteen months, but that is according as the year is.

The city of Beaune contains one very considerable plot of vineyards; it contains only four hills, which are about four miles in length from Pomard to Savigny. The first of these hills is called St. Desire; the second, the Monte Rouge; the third, Les Greves; and the fourth, the Fountain of Marconney. These different soils produce wines which participate of those of Volnet and Pomard, without the faults of them; they have a little more colour, many good qualities, and lastingness. The wines of Beaune last, some more, and some less, but they do not last above two years; they are sweeter, more agreeable,

able, and more merchantable, than the two preceding, and much better for health. The colour of these wines is not equal, because that depends much upon the manner of making them; or that they let them remain more or less hours in the vat, according as the climate is more or less delicate where it is made. There are in these four hills certain inclosed cantons, which are in great reputation. The Feves, the Cras, the Greves, as also the King's Inclosures, are very delicious.

Alosse is the fourth vineyard of the Primeur; it is situated upon the declivity of a hill, about three miles from Beaune. This valley is an ascent so gentle, that one can scarce perceive that one ascends till one has come to the top of it. This little village produces wines of an extreme delicacy; they are less brisk than the former, but of a taste more flattering; the colour is a little more soft, and less sparkling, but fine; and, like the hill that produces it, the wine is too little elevated, and too much declining; it partakes neither of the firmness nor of the stiffness of the wines of the height of the hills; it has all the tenderness, nothing of the hardness, and of consequence, is subject in a little while to grow ropy, and to take the bad quality of sweetness; nevertheless it is sent to foreign countries, but it requires much choice and judgment.

Pernand, which is between the last vineyard and the grand vineyard of Savigny, is of a greater extent, but is of small account, the wines being not very delicate; they are of the quality of the preceding vineyards, but harder and firmer, because they are produced upon a hill that is higher and steeper. There are some vats very delicious, and these go into other countries, but under the name of Beaune wine.

Chassagne is not very considerable for its extent, but is of greater reputation for its wines. This, in my opinion, would be more fit for England, because it would better bear carriage by land and sea. It is extremely

extremely strong, full of fire, and heady. It is commonly tart,* which renders it more durable than the others; but if persons have skill and leisure to bottle in the proper time, and to drink it when its tartness begins to fall, it is one of the noblest wines in the world. If I had the office of providing the king's wine I would go into Burgundy to choose it; and in chusing the wine of this climate, I should be likely to succeed. This is the only wine that one may leave in bottles without fear of its growing ropy, or changing its colour, or growing eager, or turning. The longer you keep it, the better it is.

It is more balmy and nourishing, but nevertheless you may not prescribe above three years for the bounds of its duration. It will be fit for drinking at the end of the second year; sometimes it lasts four years, when the vintage has been very good. This is the rank of wines in the Primeur, though its duration is a great deal longer. Savigny is a great extent of ground between Beaune and Pernaud, situated in a valley formed by the separation of the two mountains. As the hills that compose this vineyard are open to the rising-sun by a great space, and as they are shut up as they approach to the setting-side, they participate of the rays of the sun one side obliquely, and on the other directly. This soil produces excellent strong racy wines, which have both body and delicacy; when they have been drawn out into bottles, they must be visited now and then, so as not to let slip the time when they should be drank. This would be a very good wine for England; it will keep as well, and better than Chassagne; it is not so delicate, nor so brisk; but it is more oily, and very good for health. Auxey is pretty near of the same situation, in a corner between two hills, which open themselves to Mussault, or as far as St. Romain, where may be seen high mountains crowned with very high rocks. This

* Acerb is meant, the austere pungent roughness of acerbity in wines indicates *durability*; tartness in wines intimates they are on the *decline*; their tendency to acidity having overcome their vinosity.

This vineyard produces wines more red and stronger than those of Savigny; but they have not the reputation of them. These wines have more body than the preceding, and ought to be the drink of all those gentlemen that would not shorten their days by drinking those heady sparkling wines, an excess in which is so dangerous.

The Second Article, of the Wines de Garde, *or those which will keep a great While.*

Nuis is a very small village, about nine miles from Beaune, in the road to Dijon. The territory of this village contains between four and five miles in extent. All those gentlemen that love the most delicate and healthful drinks, have the wines of the hills of Nuis for their tables. These wines are at first very rough, sharp, and tart; they require to be kept till their second, third, fourth, and fifth years; and when their roughness and hardness are gone, their tartness being fallen, there comes in their place a perfume and balminess very delicious. They are of a deep velvet colour, and yet neat and brilliant.

The Close of Vogeot is situated a league from Nuis, on the side of Dijon; it appertains intirely to the monks of the famous abbey of Citteaux, built between the Saone and this hill. The wine which it produces comes nearer to that of Chassagne than to any other. It is very excellent, and is drank in foreign countries.

Chambertin produces, to my liking, the most valuable wine of all Burgundy. It is situated between Dijon and Nuis. It contains the qualities of all the other wines without their faults. This is what one may forget without fear. I have drank it six years after it has been produced, and it poured troubled and thick into the glass, but grew clear immediately, and by its motion recovered its spirits, and a

colour

colour the most lively and neat; and they also sell it as dear again as the other wines of Burgundy. It was sold the last vintage but one, for forty and forty-two pounds sterling the chantier, when the wines of Volnet, Pomard, and Beaune, sold for not above twenty pounds sterling a queue, which contains, as I have said before, four hundred and eighty Paris pints. Lewis the XIVth drank no other wine; it was annually engaged for his use by the resident agent.

The Third Article. *On* White Wines.

Before I begin to treat on white wines, it is proper to let you know, that it is made from a masculine kind of grape. This has two qualities that the grapes of the other colour have not. The first is this; that if the vintage be late, and that the white frosts and great cold come, it resists the hoar-frosts; while the black grapes grow sour, withered, and shrivelled, immediately. The second is, that as soon as these white grapes are cut, they must be put into the press without entering the vat, and without being trod as the black grapes are; for if they were put there, they would give only a livid, ruddy, yellowish liquor. I thought myself obliged to acquaint the public with that.

Mussault is, after Beaune and Nuis, the largest vineyard of Burgundy in extent; its wines are generally approved in Germany and the Low Countries, and throughout all France; I know not whether they are so in England or not. The wines which this soil produces, in all hot and dry years, are delicious, sparkling, agreeable, warm, and beneficial; they are not dear, and, if they were well-chosen, they would do us honour in England, and be a pleasure to those who drink them. When they are kept above a year and an half, they sometimes grow yellow and eager. Puligny is a vineyard next to Mussault,

but

but much more in the plains, which produces the best white wines; they are, within a very little, of the same quality of wines of Mussault, but their fame is not divulged, and the name is almost unknown. Alosse, of which I have spoken in the article of the first wines, produces also excellent wines.

Morachet is a little plot of ground between Chassagne and Puligny, in the plain, which is in the possession of one vein of earth, which renders its soil wholly of the same kind; it produces a white wine the most curious and most delicious in France; there is no wine of Cote Rotie, Muscat, nor Frontignan, that equals it. It produces but a very small quantity, and it sells very dear: and, in order to have a small quantity of it, it ought to be bespoken a year before, because this wine is always bespoken before it is made. But great caution is to be taken not to be deceived, for the neighbouring vineyards of this close partake a little of the quality, and oftentimes pass for Morachet; and therefore it will be absolutely necessary to have a faithful correspondent. This wine has those qualities that neither the Latin nor the French tongue can express. I have drank it of six or seven years old, and am not able to express its delicacy and excellence.

I am now going to treat concerning all the vineyards of the Upper Burgundy. Those who have passed the grand road that leads from Dijon to Lyons, the length of the hills, will do justice to my exactness; and I desire those that have not been there, to believe that this relation is agreeable to truth. I have an hundred times heard boasting of the wines of many hills near Auxerre, to which they give the name of the wine of Burgundy; it is true, those hills are in Burgundy, but they are ninety miles distant from the true hills, of which I spoke just now, which only produce these wines of Burgundy which are in reputation, and which they drink after two manners, by the nose and by the mouth, either both at once, or separately; both at once, in that when one drinks them, the pleasure which he has in the

the smell vies with the relish it has on the palate; and separately; so that a person that has been used to drink it, may know whether it be the true Burgundy or not by the smell, or sweet odour. The good tasters taste it by their nose, before they put it to their mouths; and all the other climates of Burgundy, as those of Chablis and Auxerre, have no such quality as the true wines of Burgundy have, although they are really made and produced there.

It remains for me to relate how these wines may be brought to England. It has always been the custom to bring those wines from Burgundy in their casks; but as the carriage is long, and there is oftentimes a risque run, so the carriers, as well by land as by sea, are not always faithful; for notwithstanding all the precaution that can be taken to hinder them from drinking the wine, they will always find out stratagems to do it. If it be packed up in casks with straw, and linen cloths, this is but a feeble obstacle to their industry. And for all this precaution, if the cask happens to leak by the way, this will be at the peril and loss of the purchaser. If these wines be put into double casks, this precaution will have no better success than the foregoing, and is exposed to the same risque; and the casks at the vintages are a prejudice to these delicate wines, because this gives the full scope to the spirits to evaporate; and of consequence they will cause a great diminution of the quality of the wine. It ought to be brought in bottles from Beaune to London; for this purpose, some agent, who buys the wines by order of the person, should be addressed to, to draw it out into bottles, and to send it in cases into England. These cases, being filled, need but be carried by land above ninety miles to Auxerre, where they may be imbarqued on the river Yone, which passes into the river Seine, and from thence to Paris, and afterwards to Rouen, where are vessels which pass very often to London.

* The Sense of Smelling is the most delicate and finest part of the Taste.

London. If one would have them come from Beaune to Calais by land, that will also be easy; for there are carriers that go thither very frequently, who would go very willingly, provided they could have cases enough to load their waggons.

The agents of Beaune would also be very well pleased to bottle the wine that they were ordered to buy, provided their correspondents would give orders for enough to make a carriage; as for example, if two or three persons would join to give orders for a thousand bottles, this would be a complete carriage; and, as those of Volnet draw their wine into bottles at the end of December, a person that would have five hundred bottles of Chassagne or Nuis, ought to join with another that would have the like quantity. The agent might bottle up these wines a year after the vintage, either more or less; and the purchasers might receive the wines of Burgundy exquisite and delicious; and in like manner all other wines that they have a mind to have. As to the price of the wines of Beaune, Volnet, Pomard, Chassagne, and Nuis, it is pretty near equal, or at most the difference is not veay great. A queue of Volnet wine contains four hundred and eighty Paris pints, which will make five hundred bottles; and will cost in the country, some years, ten, twelve, fourteen, or eighteen, and at most twenty pounds sterling. The carriage may cost to Calais twelve or thirteen livres; and afterwards from Calais to London a very small matter; so that, taking the years one with another, the dearest wine of Burgundy, except that of Chambertin, which is the dearest, would scarce, in London, stand in fourteen or fifteen sols a bottle, the duty not being reckoned in.

I shall next insert a curious account of the method the Italians follow in planting their vineyards, and making their wine, which I received from an ingenious correspondent in that country, who has some vineyards of his own, and has been very exact in his observations upon the different methods now practised by the *Italians* in their *vineyards;* which is as follows:

WINE VINEGAR.

Average Account taken for Twelve Weeks,

Average Account to sundry Accounts Dr.	£.	s.	d.	£.	s.	d.
To 224 Cwt. Materials, at 15s. ......£.	168	0	0			
To 168 ditto at ditto......	126	0	0			
To 112 ditto at ditto......	84	0	0			
To 60 ditto at ditto......	45	0	0			
564	423	0	0			
To 42 Cwt. of Materials, at 45s. per Cwt.........	94	10	0			
To Fermenting and Flavoring Ingredients, at 8l. 5s. per week.........	99	0	0			
Materials				616	10	0
Wages per week, at 4l. 10s.	54	0	0			
Fuel per ditto, at 4l. 12s.	55	0	0			
Rent, Taxes, and Contingencies, ditto, 6l.	72	6	0			
Sundries				181	4	0
To Excise on 14,560 gals. of different sorts of brown Wine Vinegars, averaged at 5d. per gal.	303	6	8			
To Excise on 14,040 gals. White Wine Vinegars, of different sorts, at 5d. per gallon..............	292	10	3			
				595	16	11
To 5 per cent. drawback on 788l. 18s. 7d. for Annual Repairs and Contingencies	39	5	0			
To 5 per Cent. Commission on 788l. 8s. 7d. for Manufacturing, &c......	39	5	0			
				78	10	0
To Balance gained				710	8	7
Amount				£. 2182	9	6

Materials for 14,560 gallons Brown Vinegar,
£168 0 0
47 5 0 for ditto
49 10 0 for ditto
27 0 0 for Wages
27 10 0 for Fuel
319 5 0 Amount laid out on 14560 gallons of Vinegar.

*N. B. For making Brown Vinegar, Red Tartar may be used.

Per Contra. Cr.	£.	s.	d.
By 14,560 gallons of Brown Wine Vinegar, at 1s. 3d. per gallon	910	0	0
By 7425 gallons White Wine Vinegar, at 1s. 6d. per gallon	556	17	6
By 4456 gallons choice White Wine Vinegar, at 2s. per gallon.........	445	12	0
By 2160 gallons prime White Wine Vinegar, at 2s. 6d. per gallon......	270	0	0
Returns	£. 2182	9	6

From 3074 10 6 the annual profit
Take 1024 16 10 one-third

Two-thirds 2049 13 8 which will more than double the Capital in a year and a half.

Returns £2182 0 6
Expenditures 1393 10 11

788 18 7 Balance.
78 10 0 Commission & Drawback.

710 8 7 Net Balance.

N. B. 710l. 8s. 7d. gained in 12 weeks, is 58l. 4s. 0½d. per week.

£318 10 0, or £319 5 0, prime cost, is about .... 5¼d. per gallon.
Real Excise on 14,660 gallons 4¾d.
Profit per gallon .... 5d.

1s. 3d. per gallon.

28,600 gallons in 12 weeks, is 84 tuns 6 barrels per week, in all 841 barrels, 6 gallons of Vinegar, or 70 barrels, of 34 gallons each, per week.

VINEGAR ESTIMATES, 1780.

Average Account taken for 12 Weeks, 18, or 24 Weeks.

(See this more accurately stated in the preceding column.

Average Account Dr.	£.	s.	d.	£.	s.	d.
To 720 qrs. Brown Malt, at 34s. ....£.	1224	0	0			
To 12 Cwt. Red Tartar ...	24	0	0			
To 1344 lb. Oil of Vitriol	24	0	0			
To flavoring and fermenting Ingredients	78	0	0			
Materials				1350	0	0
Wages, at 4l. 10s. per week................	54	0	0			
Fuel, at 4l. 12s. ditto.........	55	4	0			
Rent, Taxes, and Contingencies per ditto	72	0	0			
Sundries				181	4	0
Excise on 37,332 gallons prime Vinegar, at 5d...	777	15	0			
Ditto on 18,660 gallons Common ditto, at 5d...	388	15	0			
				1166	10	0
Expenditures				2697	14	0
To a drawback of 5 per cent. on 801l. 18s. for manufacturing	40	1	9			
To a drawback of 5 per cent. on ditto for Annual Repairs and Contingencies	40	1	9			
				80	3	6
To Balance gained on 12 weeks work				721	12	6
Amount				£. 3499	10	0

Per Contra. Cr.	£.	s.	d.
By 55,992 gallons of Vinegar, averaged at 15d. per gallon, from No. 10 to No. 20	3499	10	0
Returns	£. 3499	10	0

55992 Brown
28864 White
27128

£801 16 0 in 12 weeks, is £66 15 0 per week, and £2474 4 0 per annum, or 52 weeks.

N. B. Except the immediate demand admitted of the work being urged on to the utmost extent, as in the above calculation, the profits would unavoidably be reduced one-third of the sum in the balance here set down, or even half, otherwise the Materials calculated to be worked up in 12 weeks, would take 18 weeks to work them up, at an increased expence of 90l. 12s. or even 24 weeks at a double expence...181l. 4s. more, that is 362l. 8s. which must inevitably reduce the balance one half.

But when the provision that is made for making Wine Vinegars, Wines, and Spirits, are set off against this, the weekly and annual Balance must exceed those here set down, although the manufactory should not be in full Trade for the two first years.

MALT VINEGAR.

Estimate of making Malt Vinegar, allowing Utensils the same as in making Wine Vinegar, and ten quarters of Malt per Day, or sixty per Week brewed, from which a tenth is deducted for Dregs and Waste, admitting sixteen barrels per Day, or ninety-six barrels per Week, of strong Worts, for prime Vinegar, and half that quantity of blue, or small Worts, for making up the prime Vinegars from 10d. to 20d. per gallon, averaged at 15d. per gallon. And taking the average price of Malt at 34s. per quarter per annum. N. B. These worts mixed, will be as strong as those brewed for Porter, and a quarter of a barrel on every quarter of Malt stronger.

Malt Vinegar to sundry Accounts Dr.	£.	s.	d.	£.	s.	d.
To 60 qrs. Brown Malt, at 34s.................£.	102	0	0			
To 112 Red Tartar	2	0	0			
To flavoring and fermenting Ingredients	6	10	0			
To 120lb. Oil of Vitriol	2	0	0			
Materials				112	10	0
Wages per Week	4	10	0			
Fuel ditto	4	12	0			
Rent, Taxes, and Contingencies	6	0	0			
Sundries				15	2	0
Excise on 3111 gallons prime Vinegar	64	16	3			
Ditto on 1555 gallons of common ditto	32	7	11			
				97	4	2
Expenditure				224	16	2
To drawback on 66l. 16s. 2d manufacturing	3	6	4½			
To ditto for Annual Contingencies on ditto......	3	6	4½			
				6	12	9
To Balance gained				60	3	7
Amount				£. 291	12	6

Expenditures multiplied by 18 weeks.
224 16 2
18

Circulating Capital 4046 11 0
Utensils.............. 600 0 0
Surplus 353 9 0

£ 5000 0 0

Per Contra Cr.	£.	s.	d.
By 3111 gallons of prime Vinegar, & By 1555 gallons of Common ditto, 4666 gallons, averaged at 15d. per gallon, from No. 10 to 26...£.	291	12	6
Returns	£. 291	12	6

, This quantity of pale Malt would make 156 barrels of modern Vinegar, at two barrels and three-quarters per quarter, and still be on the above par with modern Porter.

N. B. This quantity of Vinegar would require full a week and a half to make it in the same Utensils as the Wine Vinegars, consequently the profit would be but 40l. per week, instead of 60l. except the consumption admitted the work being forced, as in this calculation.

The wet or dry lees of Wine dissolved in some warm Wort, and added to the rest, is still better than Tartar as a ferment.

WINE VINEGAR.

55+10=65 and 40+10=50 and 35+10=45 and 30+10=40 Gallons.

Average Account Dr.	£.	s.	d.	£.	s.	d.
Utensils ....£.				500	0	0
To 56 Cwt. of Materials, at 15s. per Cwt.........	42	0	0			
To 3½ Cwt. ditto, at 15s.	8	2	6			
Flavoring and fermenting Ingredients, and Chemical Corrector ...	8	5	0			
Materials				58	7	6
Wages per week	4	10	0			
Fuel ditto	4	12	0			
Rent, Taxes, and Contingencies per ditto.........	6	0	0			
Sundries				15	2	0
Average Excise on 3024 gallons of Wine Vinegars, from No. 15 to 30, at 5d. per gallon				63	0	0
Expenditures				136	9	6
Multiplied by 18 weeks						18
				2456	11	0
Surplus to purchase Rape, and buy Casks to contain and sell the Vinegars in				543	9	0
Total Capital				£. 3500	0	0
Expenditures brought down				136	11	0
Drawback, at 5 per Cent. on 90l. 5s. for manufacturing	4	10	3			
Drawback, at 5 per Cent. on ditto, for annual Repairs and Contingencies	4	10	3			
				9	0	6
Balance gained..............................				81	4	6
Amount				£. 226	16	0

Per Contra. Cr.	£.	s.	d.
By 3024 gallons of Wine Vinegar, from No. 15 to No. 30, averaged at 1s. 6d. per gallon.......... ...£.	226	16	0
Returns	£. 226	16	0

To Expenditures.................. £136 11 0
To Drawback on 52l. 10s. 5 5 0
To Balance............................ 47 5 0

189 1 0

Per Contra. Cr.

By 3024 gallons of Vinegar, at 1s. 3d. 189 1 0

3000 gals. £187 10 0
600 gals. 37 10 0
40 gals. 2 10 0
} at 1s. 3d. per gal.

207 10 0

Excise on 3640 gals. 75 16 8
Expenditures 73 0 0

148 6 2

52l. 7s. Drawbacks ... 5 16 0
Balance.................. 57 7 10

£. 207 10 0

MALT VINEGAR.

Average Account taken for Six Weeks.

Average Account to sundry Accounts Dr.	£.	s.	d.	£.	s.	d.
To 60 qrs. brown Malt, at 34s. per qr..........£.	102	0	0			
To 112 lb. Red Tartar...	2	0	0			
To flavoring and fermenting Ingredients	6	10	0			
To 120 lb. Oil of Vitriol	2	0	0			
Materials				112	10	0
Wages, per week.........	4	10	0			
Fuel, ditto..................	4	12	0			
Rent, Taxes, and Contingencies	6	0	0			
Sundries				15	2	0
Excise on 3111 gallons prime Vinegar, at 5d....	64	16	3			
Ditto on 1555 gallons common ditto, at 5d...	22	7	11			
				97	4	2
Expenditures				224	16	2
Multiplied by						3
				674	8	6
Drawback, at 5 per Cent. on 144l. 4s. for manufacturing..................	7	4	0			
Drawback at ditto, for annual Contingencies and Repairs on ditto.........	7	4	0			
				14	8	0
Balance gained				129	16	0
Capital				818	12	6
Multiplied by 3, gives circulating, that is 18 week's work						3
				2455	17	6
Surplus to purchase Rape, and buy a Cask to contain, keep, and sell the Vinegar in..........................				544	2	6
Utensils				500	0	0
Capital				£. 3500	0	0

Per Contra. Cr.	£.	s.	d.
By 3111 gallons of prime Vinegar, & By 1555 gallons of common ditto, making 11 sorts of Vinegar from 10l. to 20l. per tun, averaged at 1s. 3d. per gal. 4666 gallons, multiplied by 3			
13,998 gallons, averaged at 1s. 3d.	818	12	6
Returns	£. 818	12	6

Prime Cost per gallon, 0 6¼
Excise, ditto 0 5
Gain, ditto 0 3¾

Average price 1 3 per gallon.

N B. 129l 16s. gained in Six Weeks, is 21l 12s. 8d. per week, and 1124l. 18s. 8d. per Annum.

WINE VINEGAR.

Average Accounts to sundry Accounts Dr.	£.	s.	d.	£.	s.	d.
Utensils......£.				500	0	0
To 56 Cwt. Materials, at 15s. per Cwt..........£.	42	0	0			
To 56 ... ditto, at 10s.	28	0	0			
To 3¼ Cwt. ditto, at 45s.	8	5	0			
				78	5	0
To Flavoring and fermenting Ingredients				8	2	6
Materials				86	7	6
Wages per week	4	10	0			
Fuel, per ditto	4	12	0			
Rent, Taxes, and Contingencies	6	0	0			
Sundries				15	2	0
Average Excise on 3024 gallons of Wine Vinegars, from No. 15 to No. 30, at 5d. per gallon...........				63	0	0
Expenditures				164	9	6
To a drawback of 5 per cent. on 62l. 6s. 6d. for manufacturing	3	2	4½			
To a drawback of 5 per cent. on 62l. 6s. 6d. for annual Repairs & Contingencies	3	2	4½			
				6	4	9
Balance gained				56	1	9
Amount				£. 226	16	0
Expenditures brought down				164	9	6
Multiplied by						18
Gives circulating capital				2960	11	0
Utensils brought down				500	0	0
Surplus to purchase Rape and buy Casks to contain and sell the Vinegars in				539	9	0
Capital				£. 4000	0	0

Per Contra. Cr.	£.	s.	d.
By 3024 gallons of sundry Vinegars, from No. 15 to No. 30, averaged at 1s. 6d. per gallon..................£.	226	16	0
Returns	£. 226	16	0

AVERAGE PRICE OF VINEGARS

BROWN.

Per Gallon. d.	*Per Tun.* £.	*Per Barrel.* £.	s.	d.	*Real Amount per Tun.* £.	s.	d.	
10	10	1	6	3	10	10	0	
11	11	1	8	10½	11	11	0	
12	12	1	11	6	12	12	0	
13	13	1	14	1¼	13	13	0	
14	14	1	16	9	14	14	0	
15	15	1	19	4½	15	15	0	Average price of
16	16	2	2	0	16	16	0	Brown Malt and Wine
17	17	2	4	7¼	17	17	0	Vinegars, at 1s. 3d.
18	18	2	7	3	18	18	0	per Gallon.
19	19	2	9	10¼	19	19	0	
20	20	2	12	6	21	0	0	
WHITE.								
18	18	2	7	3	18	18	0	The general Sale Price,
20	20	2	12	6	21	0	0	or Medium Average
22	22	2	17	9	23	2	0	1s. 6d. of Wine Vine-
24	24	3	3	0	25	4	0	gars, White.
26	26	3	8	3	27	6	0	Average 2s. per Gal.
28	28	3	13	6	29	8	0	Average Price of
30	30	3	18	9	31	10	0	White, of an extraor-
32	32	4	4	0	33	12	0	dinary quality.
34	34	4	9	3	35	14	0	Average 3s. per Gal.
36	36	4	14	6	37	16	0	
38	38	4	19	9	39	18	0	3s. 6d. per Gallon, the
40	40	5	5	0	42	0	0	best old Superlative
42	42	5	10	3	44	2	0	Prime.

Prime Cost per gallon, ... 0 7
Excise, ditto 0 5
Gain, ditto 0 6

Total 1 6 per gallon.

N. B. 56l. 1s. 9d. per week, is 2916l. per annum.

The following Estimates were made out in 1786, principally extracted from Work done or doing; the Profits were much underrated. This can be authenticated by the few who were permitted to reduce them to Practice.

BRANDY ESTIMATE.

Brandy to sundry Accounts,		*Dr.* £. s. d.	*Per Contra*	*Cr.* £. s. d.
To 5 Tons of Molasses, at 15l. per ton		75 0 0	By 12 weeks, or three lunar months, Returns, at 79l. 9s. 8d. per week, is 955l. 16s. which returned four times within the year is	3815 4 0
4 Cwt. Argol, at 2l. per Cwt		8 0 0	The 13th Lunar month	317 8 8
Chemical Corrector	£3 5 0			
Chemical Ferment	3 5 0			
Flavouring Ingredients	6 10 0			
		13 0 0		
Coals, per week	£6 0 0			
Wages, ditto	3 0 0			
Rent, Taxes, Contingencies, &c.	3 0 0			
		12 0 0		
Weekly Expenditures		108 0 0		
Comparative Excise on 1000 gallons of Brandy		183 6 8		
Total Weekly Expenditures		291 6 8		
Multiplied by 12 weeks		12.		
Total Circulating Capital		3496 0 0		
Utensils about		504 0 0		
Total Capital employed		4000 0 0		
Balance		133 2 8		
Account		£4133 2 8	Returns	£4133 2 8

Weekly Account.

Brandy to sundry Accounts		*Dr.*	*Per Contra*	*Cr.*
To 5 Tons Molasses, at 15l. per ton		75 0 0	By 1000 gallons genuine Brandy, at 7s. 6d. per gallon	375 0 0
4 Cwt. Argol, at 2l.		8 0 0		
Chemical Corrector	3 5 0			
Chemical Ferment	3 5 0			
Flavoring Ingredients	6 10 0			
		13 0 0		
Coals, per week	6 0 0			
Wages, per ditto	3 0 0			
Rent, Taxes, Contingencies	3 0 0			
		12 0 0		
Expenditures		108 0 0		
Comparative Excise on 1000 gallons of Brandy		183 6 8		
Drawback on Weekly Balance, 83l. 13s. 4d. at 5 per cent.		4 3 8		
Net Balance		79 9 8		
Amount		£375 0 0	Returns	£375 0 0

Annual Account.

Brandy to sundry Accounts,	*Dr.* £. s. d.	*Per Contra*	*Cr.* £. s. d.
To sundry Utensils	540 0 0	By 79l. 19s. 8d. balance gained per week, is per annum	
To circulating Capital	3496 0 0		
To Balance cleared the first year, besides refunding the capital laid out,	131 16 0		
Amount	£4131 16 0	Returns	£4131 16 0

To £1 6 8 Error in the Annual Account, not discovered until the accounts were closed.

By £1 6 8 Error in the Annual Account, not discovered until the Accounts were closed.

RUM ESTIMATE.

Weekly Account.

Rum to sundry Accounts,		*Dr.* £. s. d.	*Per Contra*	*Cr.* £. s. d.
To 5 tons Molasses, at 15l. per ton		75 0 0	By 1000 gallons genuine Rum, at 6s. 6d. per gallon	325 0 0
Chemical Corrector	2 10 0			
Chemical Ferment	2 10 0			
Flavouring Ingredients	3 0 0			
		8 0 0		
Materials		83 0 0		
Wages	3 0 0			
Coals	6 0 0			
Rent, Taxes, Contingencies	3 0 0			
		12 0 0		
Comparative Excise		183 6 8		
Expenditures		278 6 8		
Drawback on Weekly Balance, 46l. 3s. 4d. at 5 per cent.		2 6 8		
Net Balance		44 6 8		
Amount		£325 0 0	Returns	£325 0 0

RUM ESTIMATE CONTINUED.

Annual Account.

Rum to sundry Accounts	*Dr.* £. s. d.	*Per Contra*	*Cr.* £. s. d.
To circulating Capital	3540 0 0	By 44l. 6s. 8d. net balance per week, is per annum	2311 16 0
To sundry Utensils	500 0 0	By balance deficient in liquidating the sum laid out the first year	1688 4 0
To surplus	160 0 0		
Amount	£4000 0 0	Returns	£4000 0 0

HOLLANDS GIN ESTIMATE, WITHOUT DISTILLATION.

Weekly Account.

Hollands from Spirits to sundry Accounts	*Dr.*	*Per Contra*	*Cr.*
To 1008 gallons Malt Spirit, at 60l. per tun	240 0 0	By 1000 gallons Hollands Gin, at 6s. 6d. per gallon	325 0 0
Chemical and Rectifying Ingredients	8 8 0		
Flavouring Ingredients and Berries	12 12 0		
Wages, Coal, Rent, &c.	8 8 0		
Expenditures	269 8 0		
To drawback on Weekly Balance, 55l. 12s. at 5 per cent	2 15 0		
Net Balance	52 16 4		
Amount	£325 0 0	Returns	£325 0 0

Annual Account.

Hollands to sundry Accounts	*Dr.*	*Per Contra*	*Cr.*
To circulating Capital	3232 16 0	By 52l. 16s. 4d. net balance per week, is per annum	2743 16 0
To sundry Utensils	500 0 0	By balance deficient in liquidating the sum laid out within the year	1254 4 0
To Surplus	267 4 0		
Amount	£4000 0 0	Returns	£4000 0 0

HOLLANDS GIN FROM RAW MATERIALS.

Weekly Account.

Hollands to sundry Accounts		*Dr.*	*Per Contra*	*Cr.*
To 40 qrs. of Rye, at 25s. per qr.		50 0 0	By 1008 gallons genuine Hollands Gin, equal to Rotterdam, at 7s.6d. per gallon	378 0 0
To 20 ditto of Malt, at 36s. ditto		36 0 0		
To 2 ditto of Wheat, at 34s. ditto		3 8 0		
62 qrs. Materials		89 8 0		
Chemical Ferment	8 18 0			
Berries and Flavouring Ingredients	9 15 0			
Coals, Rent, Taxes, &c.	12 9 0			
		31 2 0		
Sundries		120 10 0		
Comparative Excise, at 3s. 3d. per gal.		162 10 0		
Expenditures		283 0 0		
To Drawback on Weekly Balance, 95l. at 5 per cent.		4 15 0		
Net Balance		90 5 0		
Amount		£378 0 0	Returns	£378 0 0

Annual Account.

Hollands to sundry Accounts	*Dr.*	*Per Contra*	*Cr.*
To circulating Capital	4528 0 0	By 90l. 5s. net balance per week, is per annum	4693 0 0
To Utensils	500 0 0	Deficient in liquidating the debt	335 0 0
Amount	£5028 0 0	Returns	£5028 0 0

N. B. The Rye and Wheat should be malted to answer the expectations of the Operator, with respect to quality; yet with the above quantity of Barley Malt, the unmalted Rye and Wheat may be used.

ARRACK FROM RAW MATERIALS.

Weekly Account.

Arrack to sundry Accounts		*Dr.*	*Per Contra*	*Cr.*
To 20 quarts of Paddy, at 50s.		50 0 0	By 1000 gallons genuine Rack, equal to Batavia Rack at 8s. per gallon	4000 0 0
To 20 ditto Malt at 36s.		36 0 0		
To 2 tons of Molasses at 15l.		30 0 0		
Chemical Ferment	6 6 0			
Flavouring Ingredients	6 6 0			
Coals, Rent, Wages, &c.	12 12 0			
Sundries		25 4 0		
Comparative Excise, at 3s. 8d.		183 6 8		
Expenditures		324 10 0		
To Drawback on Weekly Balance 75l. 9s. 4d. at 5 per cent		3 15 6		
Net Balance		71 13 10		
Amount		£4000 0 0	Returns	£4000 0 0

ARRACK FROM RAW MATERIALS, CONTINUED.

Annual Account.

Arrack to sundry Accounts	*Dr.* £. s. d.	*Per Contra*	*Cr.* £. s. d.
To circulating Capital	3894 10 8	By 71l. 13s. 10d. Net Balance per week, is per annum	3747 19 4
Utensils	500 0 0	By Balance deficient, &c.	646 11 4
Amount	£4394 10 8	Returns	£4394 10 8

ARRACK FROM SPIRIT, &c.

Weekly Account.

Arrack to sundry Accounts	*Dr.*	*Per Contra*	*Cr.*
To 3 tons of Malt spirit, at 60l.	180 0 0	By 1000 gallons of Arrack, at 7s. per gallon	350 0 0
To 1 ton of Molasses ditto, in the last stage of Fermentation	78 15 0		
Chemical and rectifying Ingredients	10 10 0		
Flavouring Ingredients	12 12 0		
Wages, Coals, and Rent, &c.	8 8 0		
Materials and Sundries	290 5 0		
To Drawback on Weekly Balance, 59l. 15s. at 5 per cent	2 19 9		
Net Balance per week	56 15 3		
Expenditures	£350 0 0	Returns	£350 0 0

Annual Account.

Arrack to sundry Accounts	*Dr.*	*Per Contra*	*Cr.*
To circulating Capital	3393 0 0	By 56l. 15s. 3d. Net Balance per week, is per annum	2912 13 0
Utensils	500 0 0	By Balance deficient, &c.	1087 7 0
Surplus	107 0 0		
Amount	£4000 0 0	Returns	£4000 0 0

Rectification of Malt and Molasses Spirit, and of converting Malt to Molasses Spirit, and Molasses Spirit to Brandy.

Daily Account.

Daily Account	*Dr.*	*Per Contra*	*Cr.*
To 1 ton of Malt Spirit	60 0 0	By 1 tun rectified Malt Spirit, pure and flavourless, resembling Molasses Spirit, or British Brandy, at 6s. per gallon	76 1 0
Chemical and rectifying Ingredients	1 11 6		
Wages, Coals, Rent, &c.	1 11 6		
Balance gained	12 18 0		
Amount	£76 1 0	Returns	£76 1 0

Daily Account.

Daily Account	*Dr.*	*Per Contra*	*Cr.*
To 1 ton of Molasses Spirit	78 15 0	By 1 ton ratified Molasses Spirit, pure and flavourless, or British Brandy, at 6s. 9d. per gallon	85 1 0
Chemical and rectifying Ingredients	1 11 6		
Wages, Coals, Rent, &c.	1 11 6		
Balance gained	3 3 0		
Amount	£85 1 0	Returns	£85 1 0

N. B. These processes, independent of their employing the Men and Utensils, are sufficiently lucrative, being but a days work, well employed in the preparation of Articles in constant demand, either for sending out as they are, or for making up goods at home.

Conversion of Malt to Molasses Spirit, and Molasses Spirit to British Brandy.

Day Account.

Daily Account	*Dr.*	*Per Contra*	*Cr.*
To 1 ton of rectified Malt Spirit	63 3 0	By 273 gallons Molasses Spirit, at 6s. 3d. per gallon	85 6 3
To ½ Hhd. best Molasses low Wines	8 15 0		
Chemical Corrector, and A. T. O. R. and B. S. & Flavouring Ingredients	1 16 0		
Wages, Coals, Rent, &c.	0 11 0		
Materials and Sundries	73 15 0		
Balance	11 11 0		
Amount	£85 6 9	Returns	£85 6 3

Conversion of Molasses Spirit to British Brandy.

Daily Account.

Daily Account	*Dr.*	*Per Contra*	*Cr.*
To 1 ton genuine Molasses Spirit	78 15 0	By 1 ton British Brandy, at 7s. per gallon	88 4 0
To the Rectification of ditto	3 3 0		
Chemical Corrector, A. T. and Flavouring Ingredients	2 2 0		
	84 0 0		
Balance	4 4 0		
Amount	£88 4 0	Returns	£88 4 0

N. B. The preceding remarks apply to this;...they both tell up at the end of the week.

(Turn Over.)

ITALIAN WINES.

The Method of managing their Vineyards, and making their Wines in Italy.

Soil and Culture. As to the soil, next to that of Chianti, which is in a manner all rocky, they prefer that of the hilly parts of this country, which has a warm stony bottom, with a loamy surface; and next to that, such as has a lime-stone or chalky bottom, with a reasonable deep surface of any good earth; but in the plains, where the wines are nothing comparable to those of the hills and mountains, they are forced to content themselves with any tolerably good sort of ground, that is neither sandy nor light to excess, nor too clayey or binding, though a pretty stiff marl does well enough. As to its exposure, they choose one that is due south, or that inclines to the west rather than to the east; and in the plains, they are obliged to be contented, as will be here related, with a north one for part of their *vineyards,* which they fence, if not naturally covered with some wood or adjacent hill, with either a good hedge or a stone-wall, against the northern blasts. The manner of preparing the ground for planting differs according to the situation of it; being performed one way when on mountains, another when on more moderate hills; and a different, in some respects, to that, when on a plain or level. In those plains which are mountainous and rocky; as also the hills where the bottom of stone is found near the surface, and is hard, they, with the help of proper instruments or else with gun-powder, make a trench of four feet and an half deep, and three and an half wide, drawing it from east to west, (and though it may be near, yet always under the summit or top of the mountain, to be covered from the north wind thereby); and with part of the stones which they raise out of the foundation they make a dry wall, (*i. e.* without mortar)

just

just below the trench; about twelve feet below this they make a second trench in like manner, levelling the ground between the trenches as well as they can, with mattocks, crows of iron, &c. and so proceed till they have finished the whole ground they intend to plant.

The use of those little walls is, to keep the little earth there is from being washed away by impetuous rains; for the carrying off of which, they make proper channels at convenient places, so that the whole plantation, at some distance, resembles a regular magnificent flight of stairs. In which trenches, at about three feet distance one from the other, they plant their cuttings of vines, somewhat slanting, about the depth of two and an half or near three feet; which being dressed, as hereafter directed, and when they come to their bearing, being kept of an equal height, make a most agreeable prospect.

When the ground is hilly, but not very mountainous, they dig a trench of about four feet and an half deep, and three and an half wide; and then, having thrown the earth to the northward, they make a second, with the earth whereof they fill the first, and so on, one under and close to the other, until they have finished the ground they would plant, the last serving for a ditch to carry the water off; into which, at proper distances, they also make little ditches to convey the water; and having so done, and thrown the earth taken out of the first trench on to the trenched ground, and levelled it so as to give an even proper declivity, they plant it with the cuttings of vines in quadrangles or other manner, at the distance of about five feet and an half, or more, as they think most proper for their ground; if stony, in the manner before related, as practised in the mountains; but if not, then as they do it in the plains, as will be hereafter described.

When the vineyard is to be made on a plain or an exact level, having staked the part out they design for walks, and laid out the divisions

divisions they intend for vines, their next care is, that each of them have a proper declivity, and that there be good drains to carry the water off; in order to which, they make the first trench exactly in the middle of the divisions, extending from east to west, of the depth of four feet and an half, and near four feet in breadth, throwing the earth taken out of it northward; when laying at the bottom stones, brushwood, bones, or almost any sort of rubbish to raise and drain it, they proceed to the second trench; with the earth of which they fill the first, and so on, till they have finished as far as the second division extends southward, laying at the bottom of every trench such rubbish as they can get; and then removing the earth taken out of the first trench over to the south side already trenched, they proceed to trench in the same manner on the north side, as far as the divisions extend; when in the last trench there will naturally remain a ditch (the side of which some very curious people wall with a dry wall) to carry off the water, whence they take care to make proper drains to carry it away. As the cuttings are of a good length there generally remains about two feet or better of them above the ground, when planted, and sometimes more, when, as it frequently happens, they find the earth shallow, so that in trenching they arrive at prime rock, or a cold blackish clay, at the depth of about three feet, and therefore they trench not lower; they plant the depth of two and a quarter, or two and an half feet; shallower than which they never plant, and even those, if the bottom be clay, they will do but little; and if rocky are apt to suffer in the summer by dry hot weather (though if once they strike their roots in the rocks they do well enough) and yield the best wine that is made in the plains, which, however, though planted with the same sort of vines as those of the mountains, and even of cuttings brought from thence, never produce near so good vines as those that grow there, notwithstanding the grapes ripen three weeks, if not a month, sooner.

N. B. This tillage and plantation is performed at any time between November and March, in dry, but not frosty weather; since then the frozen earth, in working, being naturally thrown into the bottom of the trench, where the vines are to make their principal roots, it retains such a frigidity, that they will thrive but badly in it; which will be the case also if the ground be laboured too wet; wherefore this trenching or thorough tillage is generally performed in February, after the severity of the frost is over, and may be planted at any time between that and April; whilst as for the cuttings, they are observed to do best when planted as soon as cut off in the dressing: but if that conveniency is not to be had, they may be brought from any reasonable distance, their cut ends only being tied up, and covered from the air with moss, straw, or the like; or if from a greater, with some earth about them, and may be kept, burying the cut ends in the ground, till such time as they can be used; but just before this is done, it is proper to put them in water for twelve hours or more, since that will influence them to strike root the better. It is not of much importance, that the cuttings be from the best sort of grapes, though that is best, if easily to be had, but may be from any vines in the neighbourhood that thrive well, for afterwards, when they come to their bearing, you may, with little trouble, ingraft them with cuttings from vines of the sorts you desire; these will bear some fruit the very year they are ingrafted, and most abundantly the next; besides, that the root of the vine or stock will receive benefit by this operation.

The plantation having been made in the manner before related, the first culture of it is performed different ways; which, as one of them has been practised but of late years, may be termed the old and the modern. According to the old way, above a month after the planting, when they begin to shoot, they cut off the tops of the plants just above the second eye that is above the ground, and so let them remain and shoot out at pleasure; only after the melons, &c.

(which,

(which, as has been said before, are planted or raised in the vacancies) are gathered, they dig, and sow at proper distances the ground with beans, kidney-beans, turnips, beets, or the like, and let the vines shoot and grow at liberty till the third year, that is, when they have been planted three years complete; then opening the earth about each plant in March, or towards the beginning of April, to the depth of about a foot, they, with their hand, clear away the superficial roots, and then throw in two handsfull of good half-consumed sheep-dung, or else of lupines that have been par-boiled; after which, with a sharp instrument (either a bill, or a strong pruning-knife) and a steady hand, they cut off the head of the plant just below the lowest shoot, which is sometimes a finger-length or two under-ground, rubbing the parts cut over with some of the contiguous earth; and then, upon its shooting, take the principal shoot, gently clearing away the rest, and fix it with a green bulrush to a small stick, to keep it, when tender, from being broken by the winds, and so let it remain till the next dressing season; when, having pruned it, leaving but one eye, they put a stick, that is something more substantial, of about three or four feet long, to support it from time to time, tying the shoot to it till the month of July, before the entrance of the dog-days, at which time they nip off the head of it, which checks its luxuriency, and renders the fruit, which it will then begin to have in small bunches of nine or ten grapes each, better and larger, tying the remainder of the said shoot to the stick; in the next year they order it in the same manner; and so on till the seventh year after planting, when it begins to give fruit to purpose; and then, at dressing, they generally leave but one head on the most vigorous plants, and only two eyes on that, and stake them with substantial stakes of better than an inch diameter, and near six feet long, one of which, or more, goes into the ground, (of which those made of *wild chesnut*, the coppices of which they cut once in seven or eight years, for resisting both wet and dry, are accounted the best); and when they begin to shoot they tie them to these with the small twigs of broom or oziers, and so

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visiting them frequently in the course of the summer to keep them tied, as also to nip off luxurious branches; they let them remain till the dog-days are over, when they clear them of some of their leaves, that the fruit may ripen the better.

Dressing. *N. B.* In dressing them after the sixth year, if they have made more shoots than one, as most of them will have done, they, as before, cut them all away, unless they have occasion with them to supply the places of some contiguous plants that have miscarried; and in moist warm weather they lay those shoots down better than a foot under the ground, carrying the heads of them where they design; and this they term propagination, or propagation; the best of the shoots that they cut off from their vines of seven years old or older, they either reserve for any new plantations that they are to make, or to sell, at about nine-pence sterling per hundred.

In dressing, from the seventh year forward, they reserve the lowest head they can, provided it be vigorous, and endeavour to keep their vines as low as may be, for the fruit to enjoy the warm reflection of the earth after the sun-beams are gone off from it, to ripen it, and give it life and vigour; but not so as to let the ends of the bunches touch the ground, or to be so near to it as that they might be dashed therewith by the rains, since that would be apt to rot the grapes. Whilst in Chianti (where the vines, though most abundant in the produce of their fruit, are not so lavish in their shoots, but are easily kept in good order, by a hand that is tolerably skilful) it is incredible how exactly even the vines are kept, above the height of four feet from the ground, which contributes to the making the beautiful prospect before-mentioned.

As to the time of dressing vines, if it may properly be so called, there is nothing wherein those people differ more, some performing it immediately after the grapes are gathered, as in *Carignano* and *Val d'Arno;*

d'Arno; others do it at all times, as their conveniency permits, and the season is mild and open, (leaving their youngest vines till the last) from November to March; and in Chianti, as the region is colder, and their vines late to remove, they do it late in the month of March, and even to the beginning of April; others again, do it at twice, in November, when they leave an eye extraordinary, and in March they cut off that extraordinary eye; which last method seems to be the best; though to have cuttings for any new plantation, it can only be properly done in February or March.

As to sowing in their vineyards they also differ as much. In Chianti they leave a space of about three feet from their vines; from thence to the low wall many sow wheat; and the soil seems to be little else but stones, and such as can only be worked by a mattock, yet it bears prodigious crops, thirteen or twenty for one; others again, in that space, will only sow the low sort of kidney-beans, lentils, and such low plants; and others again will not sow any the least thing at all, as in the general they do not in the vineyards on the hills; but in the plains, after the heads of their vines are risen so high, as to be higher than the tops of beans, they make no difficulty between every row of vines to sow a row of them, as the most scrupulous do not, to sow late in April, a row of kidney-beans; whilst some, of late, laying two rows of vines into one, whereof with strong stakes and canes, they make a sort of espaliers, and in the middle, that is, between row and row, being near four feet from each, which, they say, being well dunged in the proper seasons, part of the nourishment going to the vines, does them more good than harm.*

As for their season of digging their vineyards, they all agree, that the later it is done in the year the better it is; wherefore, in the places

* This I very much doubt.

places where they sow nothing, they let work alone till the latter end of April or beginning of May, when, according to the nature of the ground, they do it with the spade or mattock; and again, the more especially to kill the weeds, and forward the ripening of the grapes, they stir it with a strong hoe or mattock, and, when they can, with a spade, in the dog-days; but in so doing, they take a most particular care that they touch not the roots of the vines, for that, if it did not kill them, would at least make them wither, and spoil their fruit.

As for *manuring* their vineyards in all parts, when they are in a bearing condition, they practice it but once in five or six years, when they open the earth about the roots, and taking away the small ones, which they have made towards the superfices, they throw in an handfull or two of sheep-dung, or of that of goats or deer; or if any of these are not easily, or in sufficient quantity to be had, then of parboiled lupines, which, although agreeable to the vine, yet being of little substance, must be the oftener repeated, every three years at least, when they cover it again; and this they peform in the months of October and November, that the winter rains falling thereon may make it descend to the utmost fibres of the roots, and afford them nourishment.

The Vintage. The season for gathering the grapes, and making the vintage, is very uncertain, depending upon the weather that has been the preceding spring and summer, which makes it sooner or later fifteen or twenty days; in Chianti, when the season has been good, they begin to cut their grapes about Michaelmas, and in the plains a week or ten days sooner. In this they every where govern themselves according to the ripeness of their grapes, and the prospect of the weather, aiming to have a perfect dry season to do it in.

Gathering,

Gathering, Pressing, and Fermenting. The grapes being of a due ripeness. and the weather warm and dry, as soon as the sun or wind has dried up the dew that was on them, they cut them and put them into piggins, and carry them, if at a distance, on mules, or, if near, between two men, to the wine-vat, and then either bruising them to a mash in the said piggins with a club, throw them directly therein, or else into a thing resembling a very large hopper, with a grate lengthwise; thin boards being placed over the vat, a lad with his feet treads them out, the juice, husks, stones, and stalks, all passing through the grate into the vat; and so they continue to do till the vat, (which usually contains from four to five tuns, sometimes eight, ten, nay, as far as fifteen or twenty, in which there are sometimes several of them) is full; when immediately, or sometimes in a few hours, before they fill it, it will set a boiling, which raises the husks, stalks, and stones to the top, and these make a thick crust; and thus the ebullition continues for many days, more or less, according to the strength of it, till it be fit to be drawn off, which is to be distinguished by the palate, wherein the greatest skill in making wine consists. The low wines of the plains are ready in about ten days; those of the hills, in about fifteen; of the mountains in Chianti, eighteen or twenty, and sometimes more; in the hastening or retarding whereof the weather has some share; so that when they are near ready, they taste them every eight hours.

N. B. The more the wines boil the drier they will be, the colour deeper; and the less, the sweeter and paler; and what is said above, is to be understood of red wines, or Muscadines; they gather their grapes carefully, and lay them three or four days, or more, in the sun, taking care to carry them within doors, or under shelter in the night time, that so no dew may fall on them.

And when they are put into the vat, they let them boil but little, five or six days at most, and then put them into the cask, shifting them

them from one cask to another, twice or thrice, to make them become fine; and for the Verdea or white Florence, as it is called, they draw it off from the vat almost as soon as it begins to boil, and has raised the crust; and then letting it boil in the cask into which they have drawn it, thirty-six hours, or at most, two days, they shift it into another, and so in a few hours into a third and fourth, to check and prevent the fermentation, which gives it the sweetness it has; but then it is never perfectly fine, though some people both in Italy and England, especially among the women, are fond of it.

Those grapes growing at the end of the bunches are weaker in quality, as well as less ripe, than those that grow nigher to the stalk; and therefore some extreme curious persons, to make a small quantity of very choice wines, cut them off, and make a wine by itself, which is much inferior to that which is made of the upper part of the bunch. This practice, though attended with trouble, may be recommended for a large parcel, in such years as the grapes are badly ripe, to have some wine, at least, in perfection. Those persons who value themselves on making the best wines, and endeavour to keep up the reputation of their vineyards and cellars, in cutting their grapes, leave the unripe or those that are infected with rottenness, together, till the last, and with them make a vat or more, by themselves, of Vin Seauro, or Refuse Wine, which serves for common use; for which also they mix water with the bottom of their vats, and the husks, &c. and make a pleasant brisk drink, much preferable to water-cider; but the weather once coming in warm, turns it eager and undrinkable.

When any wines are boiling in the vat, it raises a warmth in the room, which is accounted good in many distempers, especially for such as have a weakness in any of their limbs, to put them into a vat of boiling wine; and the husks, &c. that come out of the vat, are esteemed very good for the like purpose. When the wines are found

to

to be ready, they proceed to draw them off, which are now properly called wines; (before which they are termed mosto, *i. e.* in English, wort) for which purpose, within three or four inches of the bottom of the vat, there is a cock fixed therein; when in small barrels they carry and put into the large buts, which, in Chianti, hold, some of them, seven or eight tuns, but generally two or three tuns, made of thick chesnut, the staves being better than an inch and an half thick, and the casks twice as high as they are broad, which they never wash; but having left a gallon or two, or, it may be, three or four, of wine in them, when they draw it off the spring or summer before; when they are about filling them again; to clear them out, they send in a lad at the door, which is made in the head of the cask, to do it with a sponge, and to wash it with some new wine; and this without wiping off any of the argol, which they think preserves the wine the better.

In these casks, which last many years, (and have argol in them of the thickness sometimes of three or four inches) they let them remain till they have an opportunity of selling them, taking care to keep them full quite to the bung, secured with a wooden stopper. This is what they practice in Chianti, where the best wines are made, and whence, from those buts, they are drawn into flasks, and carried, at the expence of about a crown for a mule-load, to Florence, in order for exportation; but in other places they draw them off into less casks, of which wines, except some Carniguanos, and those of Val d'Arno, few or none are exported, but serve for the consumption of the country; some of these have a pleasant flavour and briskness, though of no great body, but many of which will not keep the summer over, except in cool cellars, in the places where made; such is the nice nature of this country wines in general. Nor are the choicest Chiantis exempt; for at two seasons of the year, the beginnings of June and September; the one when the grapes are in flower, and the other when they begin to ripen, some even of the best wines are

apt to change, especially at this latter season; not that they turn eager, but take a most unpleasing taste, which renders them unfit, not only for drinking, but even to make vinegar of; and is called the Settembrine. And what is most strange is, that one cask drawn out of the same vat shall be infected, and another not,* but be perfectly good, and yet both have been kept in the same cellar too.

As this change happens not to wine in flasks, though that will turn eager, I am apt to attribute it to some fault in filling the cask, which must always be kept full, which either by letting alone too long, till the decrease be too great, and the head or scum that there naturally is on all wine, thereby being too much dilated, is subject to break, or else, being broken by hasty filling-up, gives it that vile taste of a rotten vine-leaf. So the case is worthy the inquiry of the naturalists, whilst it is evident, at least for the first year after it is made, wines in general are, more or less, affected by the change the vines or grapes at that time undergo; and if they get well over the time of the grapes flowering, will keep good till that they begin to ripen. As for the time that the wines are fit to drink, the poorer sorts of people drink that of the plains almost as soon as drawn off; but from the 11th of November may be said to be its proper season. Those of the hills are a very pleasant drink about Christmas, and during the spring; but until June the Chiantis are not esteemed to be fit for drinking, though they are fit for exportation in butts in December; and in the flasks and chests about the beginning of February; if sooner shipped off in that manner, though apparently fine, there will be a sediment in the flasks.

The art of brewing, or making-up, wines (further than the throwing into each great butt the quantity of two or three hatsful of the choicest grapes they had preserved, and laid on mats in the sun for that purpose, which were picked from the stalks, and are esteemed proper

* A defect arising from a depraved taint in the cask into which wine is drawn off.

proper for their wines to feed on, and which they call governo) was not known in Chianti, (though the hosts here practised something like it, mixing the small wines of the country with the strong ones of other parts; and fining their white-wines with isinglass, whites of eggs, lime, and the like; and were thought to put alum into their red wines to preserve them, and promote a thirst in their guests) till on the breaking out of the first French war, an English merchant from *Bourdeaux* came into these parts, with a view to accommodate the wines which were made in the best part of Chianti, and were naturally as bright as a ruby, with a pleasant *flavour*, and a silky softness, to the English palates, then in love with the deep-coloured rough clarets; who instructed them first in the making of black wines, with the Labrusco, or wild grape; which being mixed with the Chiantis, gave them a deeper colour, and a rougher taste; and being liked in England, gave the first occasion to great quantities being sent thither every year in casks; in the making of which the said gentleman was the first that instructed them; for before, their casks were, as above related, very unwieldy. This put them also (there being a demand for their wines) upon increasing and inlarging their cultivations, and making some of them in such places, as the exposition was not very proper for; as also to cultivate in vineyards the said Labrusco, or wild grape, and which certainly was the most proper to mix with their other grapes in the vat, fermenting them together. So all succeeded pretty well, till a vintage proving very bad, and their being a great demand of their wines for England, by mixing the low wines with the high ones of Chianti, which that season were not very good, they brought these wines into such a disreputation, that they have never been able to regain their credit, though they have since, many times, had those that are good.

Whether it be that the taste of the people is run upon Portugal wines, or some other cause, they have never been able, as I said, to recover it so as to have any considerable quantity exported in casks

from these parts; and the person that first directed the affair, had the dissatisfaction to see his project miscarry, after it had in a manner succeeded, and himself reaped considerable benefit thereby. At present therefore, what does for England is chiefly in chests, and no more black wines, as used to be formerly, and these are sent just as they are made; but still in Chianti, as they have cultivations of the Brusco grape, (which, however, is much different from the wild one, and becomes much larger and more generous) they continue to mix them with their other grapes, which gives a great colour as well as a roughness to their wines, and is agreeable enough to the English taste.

Having thus acquainted you with what I know, and can learn in relation to the making and managing of vineyards, and the wines they produce, it remains for me to add an evil, that, besides the ordinary ones of hails, storms, and frosts, attends the cultivation of the vines of Chianti, and the parts contiguous; for in the plains there is no such thing: and that is, a very small kind of blackish, or very dark-green catterpiller, which in the month of May attacks the young shoots of the vines, when the grapes are in embryo, and destroys them; for which, however, they have a most certain remedy, which is, to make a little ring of bird-lime round the foot of each vine, about eight inches above the ground, which none of these noxious insects (which I presume proceed from the earth, and are not brought from the air, as some of the like are thought to be, though these come generally with an easterly wind) being able to pass, most effectually does the business; and as they, in that region, come almost every year, the trouble of so providing against them is become habitual to the cultivators.

Near Aguileia, in Lombardy, is the Roseta, and near Pavia, is the Vino Placante. The wines not before named to be drank in Padua, are, the Brescian, Veronese, Palacentine, Lumelline, and Pacine, all of which

which are tolerable. The low wines of Italy (that is, the small wines) with the pricked wines, make a tolerable Brandy, and excellent Vinegar. The Brandy would be excellent, if they did not mix the lees of all their wines with the low and pricked wines, previous to distillation. There is plenty of different wines in almost all the numerous ports of Italy, pleasant to drink on the spot, but few are exportable except *Florence*, the importation of which into those kingdoms has very much declined.

GRECIAN WINES.

The incomparable Malmsey, so often mentioned, has been claimed by Spain, Italy, and Greece, but probably owes its origin to *Candia*, a noble, spacious, and delightful island, situated in the very best part of the Mediterranean and Levant Seas, abounding in *Wine* and *Oil*. Had it belonged to the English, Dutch, or French, or to any other than the *Venetians*, it would have been the garden of Europe. It was taken by the Turks in 1669, who began their attack in 1645, and unfortunately for the rest of Europe changed into the possession of still worse masters. It was anciently recorded in sacred and prophane history under the name of *Crete*, and reputed to have had an hundred cities; at present it has but thirteen. The inhabitants are principally *Greeks*. The Turks, who have hitherto ruined the commerce of the countries they have conquered, begin to see that it is their interest to encourage trade; and the immence revenue they have lost by rooting up the vineyards wherever they came, have for some time relaxed in their inveteracy to the juice of the grape. The grapes are so excellent, and the soil and climate so congenial to the vine, that they cannot make bad wine in Candia, though it is now much inferior to what it was formerly when they supplied nearly the whole of the Venetian consumption, that is to the amount of one hundred and fifty thousand

baricos

baricos * annually. The nature, quality, and consumption of *Malmsey* has been sufficiently dwelt on already. This stupendous island is capable of producing ten times the quantity of wine it now exports.

Cyprus wine is excellent, the produce of a large commercial island of that name, situated in that part of the *Mediterranean Sea, called the Levant;* and since the recent expeditions of England and France to Egypt, in the way of being much better known than for some time past. This is a potent white wine, of a very keeping quality, improving by age; it is rather of a high colour, sweet, pungent, and balsamic. Besides this rich and pleasant wine, there are some others, consumed chiefly by the Greek inhabitants, and all who resort to the island, as common drink; and others which are exported to *Constantinople, Alexandria, Grand Cairo,* &c. This island has always been remarked for the excellency of its wines, particularly that named *Cyprus,* being more immediately extolled for its extraordinary quality of keeping for many years in any climate, and improving by age. The *Greek wines,* produced from the several islands of the *Archipelago,* were often mentioned by HYPOCRATES, particularly those of *Crete* and *Cyprus.* The *Candiots* and *Cypriots,* before the conquest of those islands by the Turks, possessed the ancient Grecian method of preparing wines, which is probably a good deal degenerated by the Turkish impolicy in discouraging the culture of the *vine* wherever they come, and their neglect of commerce.† *Cyprus* contains twelve cities, and eight hundred villages. *Famagusta* is the principal port.

The produce of these islands in corn, wine and oil, cattle, fowl, and fish, wax and honey, independent of their mineral productions, render them desirable to the potentates of Europe, and their situation in the Mediterranean an acquisition of incalculable importance to England or France. To the united kingdoms of Great Britain and Ireland, who have no wines of their own growth, they would be invaluable, not merely on this account, but on account of their situation. *Candia,* the mistress

* A barico is a quarter-cask, four to the pipe.

† See the preparation of Auspruch, p. 156.

mistress of the Archipelago, commands the navigation of the Ægean and Ionian Seas, which must be crossed by all ships bound through the *Dardanelles* to *Constantinople*. This unhappy island, once the garden and magazine of the eastern world, though now comparatively a wilderness, exports one million five hundred thousand gallons of oil per annum, one thousand bales of raw silk, called white by them, by us baladine silk, of two hundred suttle pounds each; cotten wool, and an immensity of cotton yarn. Ships touch here in their passage to or from Constantinople, Marseilles, Alexandria, and mostly all others trading between the coast of Italy, Greece, and the Levant. These Islands would be the *key* of the Eastern empire to *Russia*. In the possession of France it would be a *hook* in the nose of the Russians and the *Turkish* empire. These united kingdoms would be rendered by their possession, the *arbiters* of *peace* or *war* in those seas, or the *guarantees of the peace of Europe*, and a barrier to the Turks and Russians against the encroachments of the French. To us they would also be an inexhaustable source of wealth and maratime strength. No person who is at all acquainted with geography can look into the map of those seas, and be insensible of the justness of these observations. It was conquered by Richard I. in the wars to the Holyland.

The next, in respect of *trade* and most important with regard to strength, is the large, populous, and commercial island of *Nigropont*, called the Queen of the Ægean Islands, more deservedly for its fertility than extent; it is above one hundred miles in length, and about thirty broad in some places, abounding in wine and oil, silk, cotton, and wool, cattle, wax, and honey, raisins, figs, and other dried fruits, for exportation. This famous island is connected to that part of the western shore of *Greece*, called *Beotia*, by a most extraordinary bridge, which facilitates its commerce with the continent. The great importance of this bridge has occasioned its being extremely well fortified, first by the *Venetians*, and subsequently by its present masters, the *Turks*. The wine is rich and pleasant, and might be made up to keep for years, and rendered exportable to any country; the island is capable of producing ten times its present quantity, but

all the neighbouring islands abounding in wines, they have not vent for it. The Venetians used to take twenty-four thousand baricos, about six thousand pipes, off their hands, and the quantity consumed on the spot is incredible. This island, from its situation, and as a place of naval strength, is the bulwark of those seas, and the distant fortress of Constantinople itself. The city of Nigropont has been from time to time so exquisitely fortified by the Turks as to be almost rendered impregnable. In this city, exceedingly strong by art and nature, the Turks have a large garrison of Janizaries, and make it the seat of their naval strength, and the residence of their Captain Bassa, or Admiral of the Sea. The number of people here greatly contribute to the commerce of the island, which has not been wasted and depopulated like the other islands; there are one hundred thousand Greeks, besides Turks and Jews. The city of Nigropont alone contains thirty thousand inhabitants besides soldiers, sailors, and slaves. *Naxos* and *Scio* are famous for their wine, anciently called *Nectar*. *Skyros* for cheap wines, and *Tinos* for the best used by the Venetians; except *Florence*, and the Mycone wine, remarkable for its richness in its original state, and weakness when watered for the Venetian sailors. The *Greeks* alone possess the art of lowering their wines with water without destroying their vinosity. An art I hope they will never disclose to our countrymen. All the islands of the *Ægean* and Ionian Seas, called the *Archipelago*, abound in *wine*, oil, fruit, and corn; some in silk, cotton, flax, wool, brandy, wax, honey, drugs, &c. They are in the possession of the Turks, and mostly inhabited by Greeks; they have not only the necessaries of life, but the luxuries in great abundance. In *Tinos* they make an excellent *brandy* from the fruit of the mulberry and arbutus trees. In *Tenedos* the best *Muscat wine* in the eastern part of Europe is made, and much of it is sent to Constantinople, to which it lies contiguous. The fruitful island of *Samos* is equally famous for its excellent wine, of which they make ten to fifteen thousand hogsheads a year. The *arbutus-tree* is an ever-green, and grows wild in *Ireland*, in many parts, of which the fruit is gathered and

brought

brought to market. This tree has its name from the resemblance its fruit bears to that of the *strawberry*. It is of an austere sour taste, which is probably the reason it is not used in England, where it is not in such plenty. The fruit of this ever-green is ripe in November, at which season the flowers are blown for the next year's fruit; so that from the time of flowering to the ripening of the fruit is one whole year. This fruit, with a due proportion of saccharine matter, would make an agreeable wine, or a good brandy. The wine of *Santorini* should not be omitted; it differs from all the other Greek wines of the Archipelago; though fine and clear, it casts a greenish colour like the Rhenish Moselle, is strong and heady, and imported by all the islands for its peculiar excellence. The *Venetians* have almost all their wines from these islands, for which they rarely pay more than a dollar a barico, that is, under two guineas a tun. The Grecian wines mix better than any other with water, of which the Greeks know how to avail themselves, and the Venetians take care to reduce the price in proportion.

GERMAN WINES. *

Rhenish wines take their name from the vicinity of the place of their growth to the *Rhine*; *hock* from *Hockheim*, a village contiguous to it; there are various other growths of Rhenish wines, which derive their names from the towns adjacent, and deviate in strength and quality in proportion as they are more or less near to the district of the principal growths. These wines are peculiarly remarkable from being durable, and improving in strength and flavour with their age; owing to the large quantity of *tartar*, which prevails in their recent state,

* See page 34.

state, which always separates in the lapse of time, what remains combining with the essential oil of the wine into strength and vinosity. When they have attained their full *maturity*, their different principles are united in just proportion, and the superfluous thrown off, they acquire a more grateful flavour and more salutary qualities.

The annual addition of a proportion of *new wine*, it is thought, greatly contributes to their more securely advancing to the great age some of them are kept. *Pliny, Hippocrates*, and the best Physicians, preferred wine in its meridian to its more advanced age. Several of these districts abound with vineyards, that produced wines which, in many respects, differ from *Rhenish*, that are of a more soft and spirituous kinds, and are in the same proportion esteemed the more these principles prevail in them, over those of the saline acid. The growth of which are principally at *Rhingaira*, and supposed to derive these qualities from their having adopted the rich *Orlean* grapes, and their suitableness to the nature of the soil. They are distinguished by the name of *Rhingarian wines*. These wines improve by age, are very grateful and salutary, and contain only such a light portion of the acid salinity, as renders them agreeable and enables them to promote appetite. On this account the Germans prefer them to those emphatically called *Rhenish wines*, and they are annually sent to Misnia Thuringia, Saxony and Silesia; while the *old hock* is sent to England, Holland, Hamburgh, and Lubeck, where they procure a better price. Good old hock may be imported from *Frankfort*. They are also deservedly commended for their medical qualities. Though generous and durable, they are less heating, and more exhilerating than much weaker wines, and eminently useful for their antisceptic qualities, in diseases where the animal humours are disposed to a putrid state, especially in low fevers of that kind. The best *old hock* has for a long time been sold for fifty pounds an aume.

Hungarian Wines. The principal growth are distinguished by the name of *Tokay*, from a high mountain on whose summit the wines were planted, which produced this celebrated wine, which may have derived a peculiar richness from the mineral properties of the soil, but doubtless much more from the treatment in the culture, as the Tokay of Mount Leat Schau, *Aushbruch*, *Aushmenhausen*, where the grapes are suffered to remain suspended on the vine after they have arrived to maturity until nearly half dried, to inspissitate the juice, in the same manner that the *Italians* prepare the grapes for their so much admired *Lachrami Christi*;—the vignerones going every morning through the vine rows, and giving each bunch of grapes arrived at maturity a twist, and hanging it over an adjoining branch of the vine, that the twist may not come out. This partially interrupts the ascent of the sap from the root, which, if wholly cut off, would permit the grapes to dry too quickly, and concentrate the juice too much to flow on moderate pressure. This, prepared from the expressed juice, first slowly flowing from light pressure, makes the most excellent *Tokay*.

Mr. *Silvester Douglas*, in the paper communicated to the *Royal Society* by Mr. Edward Poore, vol. lxiii. 1774, p. 291, remarks, it is a vulgar error, asserted by some authors, that the quantity of Tokay wine is small, and that the greatest part is kept for the Imperial family; for the quantity now produced is very great, and belongs to various proprietors, among whom the Prince of *Trautzon* is the chief; further observing, that the extent of the Tokay district occupies a space of ten English miles square, containing many hills, interspersed with large plains and villages; near some of these, particularly *Talia* and *Tarczal*, the wine is better than what grows on the hill of Tokay, but it all goes under one general name. The vintage is always as late as possible; for they leave the grapes as long on the vines as the weather permits, as the frosts from the end of August, which are very keen during the night, are thought to be of great service to the

fruit;

fruit; by which many of the grapes are shrivelled, and have, in a great measure, the appearance of raisins. There are four sorts of wine made from the same grapes, by the name of *Essence, Auspruch, Masslasch,* and common wine.

GENUINE AUSPRUCH.

The Process of preparing Tokay Wine.

The over-dried and shrivelled grapes being carefully separated from the perfect, are put into a perforated vessel, where they remain as long as any juice runs off, by the mere pressure of their own weight; this is put into casks and called the *essence.* On the grapes from which the essence has run off, is poured the expressed juice of the others from which they had been picked, and they tread them with their feet. The liquor obtained in this manner stands to ferment for a day or two, after which it is put into casks, which are kept in the air for about a month, and afterwards put into the cellars; this is the *Auspruch.* The same process is again repeated by the addition of more of the common juice to the marc of the grapes, which have already undergone the two former pressures; only they are now also wrung with the hands; this gives the *Masslasch.* The fourth kind is made by taking all the grapes together at first, and submitting them to the greatest pressure; this forms the common *Vin du Pais,* the whole of which is probably consumed in the country.

The Essence is thick, and seldom perfectly clear, very sweet and luscious; it is chiefly used to make up the other kinds; and when mixed with the Masslasch, forms a wine equally as good as the Auspruch, and often sold for it. The Tokay wines, Essence and Auspruch, are both very durable, but in general not fit to drink until about

about three years old. The principal Auspruch wine is made by an addition of Essence wine. This is the Tokay now usually drank at the Emperor's table, and no other; of which presents are made to foreign ambassadors. The price of this wine has much increased, from the great demand made for it. The court of Russia has a resident agent that annually purchases from forty to sixty *authiels* of *Auspruch*, but never of any other sort. An *authiel* is a small cask, containing eighty *Hungarian mediæ,* a measure equal to about two-thirds of an English quart.

An inferior kind of Auspruch is made by making-up *Masslasch wine* with a less quantity of Essence. This wine, however greatly esteemed, may be easily distinguished by its austere taste, acquired from the stronger pressure of the grapes. The *Poles* are particularly fond of this astringency, which they call the taste of the *root,* and great quantities of it are transported to that country.

The *Buda Wine* is very like *Burgundy,* and perhaps equal to some of it. A German author asserts, it was a favourite wine at the court of London in the reign of James the First. The *Sexard Wine* is strong and deep-coloured, not unlike the wine of Languedoc, called *Bourdeaux Claret.* It is a very cheap red wine, of good quality. Sexard is on the Danube, between Buda and Esset. These wines may be imported from *Triest,* an Imperial port in the Gulph of Venice, up the Adriatic Sea. The *Auspruch Tokay* has rose to a very great price, having risen from sixty ducats to one hundred, and one hundred and fifty ducats the *authiel.*

Dr. Edward Barry, from whose Treatise on the Wines of the Ancients I have made some extracts, very justly observes, that this was the *Grecian* method of preparing their rich wines. To which I may add, the *Italians* at this time make their rich luxurious *Lachrami*

Christi

Christi in the same manner; the *French,* their best *Frontignac, St. Lawrence,* and *Muscadine* wines, in a similar manner. Therefore, this *Process* may serve as a specimen for each.

Rhenish Wines, however poignant and tart, are the produce of sweet delicious grapes, and owe their dryness and inimitable pungency to a complete fermentation, which resolves a considerable portion of the most subtile part of their tartar, and combines it into vinosity and spirit in the wines, throwing off the more earthy parts with the gross mucilage in the first fermentation, and depositing the superfluous saline part of the tartar on the bottom and sides of the cask, under the form of what is called in commerce *argol,* during the subsequent fermentation. The Must of these wines are so rich in saccharine matter, that they furnish hydrogen enough to attenuate all the remaining mucilage. Hence tenuity without weakness, and poignancy without positive acidity, in the best Rhenish wines. The mucilaginous principle, the substance in wines on which the acetous fermentation depends, is usually long decomposed before these wines attain the very great age they arrive at, and which is the total decomposition, or separation of the tartar, in these old wines; hence their longevity. They are no longer capable of alteration; wines deprived of their mucilage ferment no more. During the length of time requisite for the completion of so perfect an attenuation, there is a gradual, and at length a total deposition of the tartar. Wines deprived of their tartar ferment no more. The anti-fermentive property of the vapour of sulphur in preventing fermentation; and the motive of the *ancient Grecians* in adding sulphuric acid to the wines intended to be preserved to a great age, was derived from the experience that such wines assimilated so perfectly as rarely to turn acid by insensible fermentation, and to be greatly superior in their vinous qualities. I have mentioned elsewhere the impracticability of adding ardent spirit to wine without injury to its vinosity, and all those desirable qualities I have just enumerated, except it is *fretted-in*; a practice, as before-mentioned,

mentioned, introduced by the Dutch, particularly at *Dort,* the most bustling town in *Holland,* not only in the wine, but also in every other trade. During this operation the cask-heads are kept from bursting out by props, shores, and wedges, to confine and concenter the gas arising from the fermentation excited, which promotes the assimilation of the spirit, with less injury to the vinosity and flavour of the wine *made-up.* There would be no occasion for props, if they watched the operation, and burned a match occasionally under the cask, which would instantly check its expansive force. This should not be resorted to, until the cask or casks were in apparent danger, and discontinued as soon as the evident expansion of the cask went down.

WINE VINEGAR.

By which is here meant the vinegar of genuine foreign wine, methodically prepared, as the German, French, and Italian vinegars; and not those prepared from cider, malt wines, or made wines, of any description whatever, in the preparation of which I have been very diffuse in the preceding books, particularly the third, where it is described as an article of commercial manufacture. All wines, especially those of a weak kind, either spontaneously, or by repeated fermentations, degenerate into a vapid kind of *vinegar.* Observation of the frequent and spontaneous occurrence of acidity in wines, no doubt, gave rise to the preparation of a more permanent and pungent *vinegar,* which is of a very different nature from the former. This can only be obtained by a regular process, from such liquors as have passed through a previous fermentation, on which so much has been said

said in the preceding books of this treatise, as to require nothing further, than the exact process practised in wine countries for making vinegar. *Boerhaave* may be justly singled out from among all the authors who have written on the subject for the peculiar accuracy with which he relates the manner of making vinegar from wine, as it then was practised, and has since continued, with scarcely any alteration; with which I have intermixed my own observations derived from practice, of a much latter date.

PROCESS.

Large vats, in pairs, open at the top, but exactly fitted with close moveable covers, are ranged in a row, under a shed or building open at the south side, standing so as to be heated by the beams of the sun, by day, equally exposed to the air by night. Between each pair a strong and capacious open receiver, made of oak, well hooped, is sunk in the earth, so as the cock in each cask near the bottom may command it. In this receiver a pump is placed, and near it a stage and a ladder for a man to ascend and work the pump, and put the covers on and off the vats, and attend to the operation; which is conducted in this manner. One, two, or three foot from the bottom of each cask a strong gratened transverse partition, or perforated false bottom, is placed, fitted exactly to the circular form of the cask; on which the *rape* or ferment is disposed of in this way; first a *strata* or layer of vine twigs are laid, some inches thick, on each *graten,* to prevent the *rape* clogging the graten, or falling through; then the vats are lightly filled up to within a few inches, or half a foot of the top. The wine is poured over the rape, until one vat is filled, and the other half full. In two or three days, according to the temperature of the atmosphere, the wine in the half-filled vat begins to heat and ferment. The cock of the full vessel is then turned, and the wine, as it flows into the receiver, pumped over the fermenting rape. In two or three days, or in

in less time, the second reap begins to heat and ferment, when recourse must be had to the same means of suffocating it by pumping up the wine of the full vat from the receiver as before. This must be alternately done every day, and in very warm weather once in twelve hours. In winter it generally takes from twenty-four to thirty-six hours to heat and ferment; both vats successively augment in heat and vigour of fermentation, until the vinegar is perfected, or finally made, which is usually in fourteen or fifteen days in summer. In winter it proceeds more slowly, and that according to the coldness of the weather.

The *reap* is the foot-stalks of the bunches or clusters of grapes, and sometimes consists of the whole of the *mark* from which the wine is expressed, saved at the vintage for that purpose. It is immediately headed up in barrels or other *air-tight casks;* if not, it presently takes air, heats, and spoils. There is no other way of preserving reap except by drowning it; that is, by filling-up the vessel containing it with wine or vinegar. The wine, in undergoing this change, leaves a kind of grease, which adheres partly to the sides of the cask, and partly to the reap; so that if they neglect cleansing the reap and cask from it once a year, the wine or vinegar turns into a whitish liquor, which is neither wine or vinegar. In casks that have never served for this purpose, the vinegar is made more slowly than in those that have been used before; at the time when they pump the wine out of the full vessel, a scum rises that should be taken off. The full cask is to be left uncovered, and the half-full one close covered; in which there ought to be left a hole, stopped up with a plug, occasionally to give vent, and examine the progress of the operation, which also keeps in the volatile acescent vapour generated by the fermentation. The operation is known to be completed when the hissing in the half-full vessel ceases. The reap will keep a year or more in use, provided the grease that adheres round the top of the cask, at the surface of the fluid, is cleansed away every morning

 with

with a linen cloth, and that which floats taken off with a little broom. The reap may be cleansed from this grease by taking it out of the vat, and washing it in baskets with water, and separating the foulness and greasiness by hand; then let it be drained and returned for use. The hotter the house or place where the *reap-vats* stand, the sooner the vinegar is made; under which circumstances it will require to be changed from vessel to vessel the oftener, on account of the speedier augmentation of the heat, and louder hissing noise of the fermentation; or the volatile spirit of the wine, not being sufficiently fixed, would be dissipated; and, though the liquor would be soured, it would be flat, instead of a sharp, pungent, strong, spirituous vinegar. For this reason, I have recommended always keeping the half-full vat accurately covered, to repel the spume of the fermenting liquor, more powerfully to re-act on the austere substance of the reap, in order to its being entangled and combined with the fermenting fluid, which would be otherwise dissipated, to the impoverishment of the vinegar. The vinegar, thus made, improves by suffering it to stand on the reap, filled up to the top so as to effectually drown the reap. The French and Italians usually make their vinegar in the summer season. The Germans sometimes use artificial heat, particularly in cold weather. Malt-wine, or any preparation of sweets, may be converted to vinegar in a similar manner. *See Vinegar, Book the Third.*

The production of vinegar may probably be as early as the preparation of wine, though not to the advantage here pointed out, which combines, in this *process*, the progressive improvement of ages. The Greeks and Romans made their strongest wines into vinegar, with whom it was as much a luxury as a medicine; so that it is doubtful to say, whether it was most employed for the culinary purposes of *food*, or the pharmaceutic purposes of *physic*. It corrects and retards inebriation; when applied externally to the nostrils, or taken internally, excites and revives from lethargy, intoxication from wine or ardent spirits, and assists in recovery from narcotics; is antisceptic,

antibilious,

antibilious, and an excellent tonic in the sea scurvy; and in most putrescent stages of the animal fluids. Its sanative qualities are too numerous and well known for me to enter further into the subject. The Roman soldiers were obliged to carry a bottle of vinegar, to occasionally mix a little of it with water, as a grateful and salubrious extinguisher of thirst, who called it *poscha*. The *Spanish peasantry* at this time use the addition of about a jill of vinegar to a gallon of water, and about a tea-spoonful of salt, as their common beverage; with no other drink than this, and no other food than bread, they sustain the labour of the field in their warm climate, exposed to the rigour of the sun, and are as healthy and athletic a race of people as any in Europe. I do not allege, but that some of them cheer their drooping spirits occasionally with a small glass of *augua-ardent*. The breakfast and supper of the domestic servants is a piece of bread and a bunch of grapes, with plain water to wash it down. The beverage of women servants at breakfast and supper, is three cups of water to one of weak chocolate; yet these women are as straight and well-limbed as their neighbours, and in every respect as desirable. For the *rationale* of this process, see the Doctrine of Fermentation scientifically reduced to practice, page 25, Book II.

THE HONOURABLE CHARLES HAMILTON'S METHOD OF MAKING GRAPE WINES. *

The vineyard at Pain's-hill is situated on the south side of a gentle hill, the soil a gravelly sand; it is planted entirely with two sorts of *Burgundy grapes;* the *Avernat,* which is the most delicate and the tenderest,

* Taken from Sir Edward Barry, Bart.'s Description of the Wines of the Ancients, published in 1775; the only process of the kind he has given.

tenderest, and the Miller Grape, commonly called the *Black Cluster*, * which is more hardy. "The first year I attempted to make red wine, in the usual way, by treading the grapes, then letting them ferment in the vat, till all the husks and impurities formed a thick crust at the top, the boiling ceased, and the clear wine was drawn off from the bottom. This essay did not answer; the wine was so very harsh and austere, that I despaired of ever making red wine fit to drink; but through that harshness I perceived a flavour something like that of small *French* white wines, which made me hope I should succeed better with white wine. That experiment succeeded far beyond my most sanguine expectations; for the very first year I made white wine, it nearly resembled the flavour of *Champaign;* and in two or three years more, as the vines grew stronger, to my great amazement, my wine had a finer flavour than the best Champaign I ever tasted. The first running was as clear as spirits, the second running was *Œil de Perdrix,* and both of them sparkled and creamed in the glass like Champaign. It would be endless to mention how many good judges of wine were deceived by my wine, and thought it superior to any Champaign they ever drank; even the *Duke de Mirepoix* preferred it to any other wine; but such is the prejudice of some people against any thing of English growth, I generally found it most prudent not to declare where it grew, till after they passed they verdict on it. The surest proof I can give of its excellence is, that I have sold it to wine merchants for fifty guineas a hogshead; and one wine merchant, to whom I sold five hundred pounds worth at one time, assured me, he sold some of the best of it from seven shillings and six-pence, to ten shillings per bottle."

After

* *Vitis Subhirsuta. Cornut, C. B. P.* The Morillon Taconne, or Munier, *i. e.* the *Miller's Grape;* this is called the *Burgundy* grape in England. The leaves of this sort are very much powdered with white, especially in the spring, when they first come out, from whence it had the name of the *Miller's Grape.* It produces middle-sized black grapes, which grow close upon the bunches, and are generally short and thick. It is an excellent bearer, and a hardy sort.

After many years experience, the best method I found of making and managing it was this. I let the grapes hang, till they had got all the maturity the season would give them; then they were carefully cut off with scissars, and brought home to the wine barn in small quantities, to prevent their heating or pressing one another; then they were all picked off the stalks, and all the mouldy or green ones discarded, before they were committed to the press; where they were all pressed in a few hours after they were gathered; much would run from them, before the press squeezed them, from their own weight upon one another. This running was as clear as water, and sweet as syrup; and all this of the first pressing, and part of the second, continued white; the other pressings grew reddish, and were not mixed with the best. As fast as the juice run from the press into a large receiver, it was put into the hogsheads, and closely bunged up.* In a few hours one would hear the fermentation begin, which would soon burst the casks, if not guarded against, by hooping them strongly with iron, and securing them in strong wooden frames, and the heads with wedges; in the height of the fermentation, I have frequently seen the wine oozing through the pores of the staves.† These hogsheads were left all the depth of winter in the cold barn, to have the benefit of the frosts. When the fermentation was over, which was easily discovered by the cessation of noise and oozing; (but to be more certain, the pegging the cask shewed when it would be quite clear); then it was racked off into clean hogsheads, and carried to the vaults, before any warmth of weather could raise a second

* See Fermentation, pages 9, 16, 22, 25, 28, Appendix.

† This is impregnating the wine with its own gas. It is similar to the process of *fretting-in*; if *brandy* was necessary it could now be conveniently added without injury to the delicacy or vinosity of the wine, and would promote its keeping in the *wood* and in the *bottles*. See page 158, Appendix.

second fermentation.* In March the hogsheads were examined; if they were not quite fine, they were fined down with common *fish-glue,* in the usual manner; those that were fine of themselves were not fined down, and all were bottled about the end of March, and in about six weeks more would be in perfect order for drinking, and would be in their prime for above one year; but the second year the flavour and sweetness would abate, and would gradually decline until it lost all flavour and sweetness. Some, that I kept sixteen years, became so like *Old Hock,* that it might pass for such to one who was not a perfect connoisseur. The only art I ever used to it, was putting three pounds of white sugar-candy to some of the hogsheads when the wine was first tunned from the press, in order to conform to a rage that prevailed, to drink none but very sweet Champaign."

If a copy can be allowed to surpass the original, this superlative imitation is an instance, and at the same time a proof, that excellence may lie in a very narrow circle, which must ever be the case where *nature* is closely followed, and *art* only operates as the hand-maid. Many gentlemen in the wine trade, in these kingdoms, are men of science, not only opulent, but possessed of a liberal education; those who are of a chemical and philosophical turn of mind, may find experiments, made on a scale like this, on their own estates, not unworthy their attention. For the *rationale* of this process, see the Doctrine of Fermentation scientifically reduced to Practice, page 25, Book II.

It is very much suspected to be a common practice among the wine coopers, innkeepers, and other dealers in wines, to adulterate bad wines in order to conceal their defects;—if, for instance, the wine be sour, they are accused of being so wicked as to throw in a quantity of

* By which it was saved from getting a turn on its lees, and from which it would never perfectly recover.

of sugar of lead, which entirely takes away the sour, at the hazard of the drinker's life. For similar purposes alum is often mixed with wine. Such substances, however, are well known to be extremely pernicious to the human constitution, particularly the former. It became of importance therefore to be able to detect them whenever they happen to be contained in wine. Several chemists, who have turned their attention to this subject, have furnished the world with tests for this purpose. To discover lead dissolved in wine, boil together in a pint of water an ounce of quick lime, and half an ounce of flour of brimstone, and when the liquor, which will be of a yellow colour, is cold, pour it into a bottle and cork it up for use. A few drops of this liquor being dropped into a glass of wine or cider containing lead, will change the whole into a colour more or less brown, according to the quantity of lead which it contains. If the wine be wholly free from lead, it will be rendered turbid by the liquor, but the colour will be rather a dirty-white than a black-brown. By this test, however, iron is precipitated when dissolved in wine, and is apt to be taken for lead,—a mistake which has ruined some honest merchants abroad. The following test is therefore preferable, as not liable to the same inconvenience. Mix equal parts of calcined oyster-shells and crude sulphur, in fine powder, and put them in a crucible, which put into a fire, and raise the heat suddenly, till it, has been exposed to a white heat for fifteen minutes; then take it out, let it cool, beat the ingredients to powder, and put them into a well-corked bottle. To prepare the test liquor, put twenty grains of this powder, together with one hundred and twenty grains of cream of tartar, and put them into a strong bottle; fill it up with water, boil it for an hour, and let it cool; cork the bottle immediately, and shake it from time to time; after some hours repose decant off the clear liquor into an ounce phial; having first put twenty-two drops of muriatic acid into the phial; cork the phials accurately with a little wax, mixed up with a little turpentine. One part of this liquor, mixed with three parts of suspected wine, will discover the presence of the smallest quantity of lead or copper, by

by a very sensible black precipitate, and arsenic by an orange precipitate, but which will have no effect on iron, if there be any; the presence of which, however, may be ascertained by adding a little potash, which will turn the liquor black, if there be any iron. Pure wine remains limpid after the addition of this liquor.

As this subject is of importance, we shall add Mr. Fourcroy's observations on the state in which lead exists in wine, and on the methods of discovering its presence:

Of the different principles which compose wine, there was no doubt, (says he) but that acids were the only ones which were capable of dissolving oxyd (calx) of lead; but was it the tartarous acid always contained in a larger quantity in wine, or the acetous acid developed in those which have become sharp, and which there is a greater temptation to sweeten? Experience had proved to me, that the acidulous tartarite of potash, or the cream of tartar, takes oxyd of lead from the acetous acid, and a precipitate of tartarite of lead is formed. The pure tartarous acid, prepared in Scheel's method, produces the same effect. In order to understand how the sharp wine which contains these two acids can hold the oxyd of lead in solution, I made the experiments, which gave me the following results. 1. The acidulous tartarite *(crem. tart.)* has no sensible action upon the oxyds of lead. 2. The pure tartarous acid has a slight action upon the oxyds, and forms on their surface a little tartarite of lead, (tartarised lead) in a white powder. 3. Wine, which only contains the tartarous acidule, would not have any action upon the semi-vitrous oxyd of lead or lithage. 4. Sharp wine, which we attempt to sweeten by the oxyd of lead, acts first upon it by the acetous acid it contains. 5. When this acetite of lead is formed, the tartarous acid precipitates in the form of tartarite of lead;—this is proved by the precipitate which the solution of the acetite of lead, or sugar of lead, forms in the wine. 6. But the acetous acid, if it be in large enough quantity, re-

dissolves

dissolves the tartarite of lead in the wine, just as distilled water would. Bergman has pointed out the solution of tartarite of lead in acetous acids for distinguishing the tartarous salt from the sulphat of lead, (vitriol of lead). 7. As this solution of tartarite of lead in the acetous acid is much quicker and more easy in sharp wines than in distilled water and vinegar, it is probable that the cause of the difference depends upon the citric and malic acids which I have found in wine, and which I shall take notice of again on another occasion. 8. Litharged wine, then, or wine sweetened with lead, contains tartarite dissolved in the acetous acids, and, perhaps, at the same time in the malic and citric acids.

It was necessary afterwards to know the properties of this combination. What experience has taught me is as follows: I particularly examined the tartarite of lead, and its solution in acetous acid. The tartarite of lead is scarcely at all soluble in water, it is in the form of powder, or of small white grains, which have no sensible taste; when it is dissolved in vinegar the vinegar is softened, its sharpness is diminished remarkably, and the solution takes a slight sweetish taste, much less strong than that of the pure acetite of lead. This taste proves, that the wine of the tartarite of lead with vinegar is not only a solution like that of salt in water, by which the properties of the salt are not changed, but a combination which gives occasion to new properties. It is a kind of triple salt, different from those we have hitherto known, formed of two acids and of one base, whereas the other tripled salts described hitherto are composed of one acid and two bases; I name this new triple salt (aceto-tartrite lead.) The acetous acid adheres to it more than water in a common solution. What is remarkable in this combination, is that the two acids appear to adhere to the base with an equal force, although they have a different attraction for it; nothing is necessary to produce this equilibrium, but to unite first the oxyd of lead with the acid to which

it adheres the most strongly, and afterwards to put this first compound in contact with the weaker acid.

It was necessary, in order to discover easy and certain methods of ascertaining the presence of lead in wine, to examine with care the properties and phenomena of the decompositions of the aceto-tartrite of lead. Fixed alkalies and ammoniac (volatile alkali) precipitate from this salt an oxyd of lead, which is of a greyish-white colour; but as they occasion a precipitate in pure wine, they cannot be of any use. The sulphuric (vitriolic) acid decomposes the aceto-tartrite of lead, and forms with it instantly sulphat of lead, which being very little soluble, and very heavy, is precipitated. The oxalic, or pure saccharine acid, and the acidulous oxalat, or the salt of sorrel of the shops, likewise decompose this salt, and take from it the lead. The oxalat of lead is precipitated in great abundance by these two acids. The sulphuric and oxalic acids not producing any precipitate in pure wine, are very proper to show the presence of lead in wine. The sulphat and oxalat of lead, when they are precipitated from wine, are coloured, whereas they are very white when they are formed in distilled water; but their red or brown colour does not prevent us from discovering them by a very simple method. If the precipitates be collected with care, and are cautiously heated upon a coal with a blowpipe, they smoke, become white, exhale vapours, pass successively through the states of red and yellow oxyds of lead, and at length are reduced into metallic globules, at the instant they are perceived to be agitated by a very evident effervescence; if we cease to blow at this instant, we obtain globules upon the charcoal. In order to this, it is necessary, however, that the charcoal be solid or not cracked, and that we should not have blown too strongly; otherwise the globules would be absorbed, and would disappear. The sulphat of lead requires a longer time to be reduced than the oxalat of the same metal, and there is a greater hazard of losing the metallic particles, which besides are in small quantity.

To

To these two fresh processes, already sufficiently certain of themselves, I wished to be able to add one which might be capable of pointing out instantly the presence of lead, by an appearance belonging exclusively to this metal, and which might unite to this advantage that of manifesting very small quantities of it. Distilled water impregnated with sulphurated hydrogenous gas, or hepatic gas, extricated from solid alkaline sulphur, (livers of sulphur) by acids, presented me with these properties. This solution blackens very deeply that of the aceto-tartrite of lead, and renders one thousandth part of this salt in water or in wine very sensible. The sensibility of this re-active is such, that we may dilute litharged wine with a sufficient quantity of water to take away almost entirely the colour of the wine, and this re-active will still produce a very manifest alteration. The sulphurated water has, besides, the advantage not to occasion any change in the wines which do not contain metallic substance, and it is not precipitated by the acids of wine, like the solutions of alkaline sulphurats. In order to procure this re-active pure, it is necessary to prepare it at the instant of the experiment, by receiving in a phial-full of distilled water, and inverted upon a shelf of a small hydro-pneumatic apparatus, filled with distilled water, the sulphurated hydrogenous gas, separated from the solid sulphurite of potash by the sulphuric or muriatic acid, first filtered through water in another phial, when the second phial contains the third of its volume of the sulphurated hydrogeneous gas; the gas is shaken strongly with the water, which fills the two-thirds of the phial, and when the absorption is over, the test liquor is prepared. This re-active changes very quickly in the air; it is necessary to make it the moment it is to be employed, and to keep it in a vessel quite full and well corked. If there is any fear that the black colour and the precipitation by the gaseous sulphurated water should not be sufficient to prove the presence of lead or spirituous liquors, I would observe, that this fear would be diminished by employing the three re-actives before mentioned, and by depending only on the correspondent effects of these

re-actives; but all suspicion would be removed, by reducing the three precipitates by the blow-pipe, and obtaining globules of lead from each of them.

Some years ago, the academy at Lyons proposed the following prize question. What is the best method of ascertaining the presence and the quantity of alum dissolved in wine, especially in very deep-coloured red wine? The prize was gained by Mr. J. S. Beraud. From his experiments, it appears that a mixture of lime-water and wine in any proportion whatever, will at the end of twelve or fifteen hours furnish a quantity of crystals which may be separated by filtration; and that these crystals will be easiest discovered when the quantities of wine and lime-water are equal; but that wine, containing alum dissolved in it, will not form crystals, when mixed with lime-water, but merely deposits a muddy sediment. To know therefore whether any wine contains alum or not, we have only to mix a small quantity of it with lime-water; if crystals are formed, it contains no alum, if not, it does. Again, if wine contains alum, the residuum that remains after filtration will, as it dries, split into quadrilateral segments, which will detach themselves from the paper which contains them; but if the wine contains no alum, the residuum, after it is dry, will remain united and attached to the paper. If one measure of wine and two-thirds of a measure of lime-water deposit crystals, we are certain that if the wine contains alum, the proportion of that alum to the wine will be less than one to one thousand one hundred and fifty-two; if, when equal parts of wine and lime-water are mixed, no crystals be deposited, we may be sure that not more than one-four-hundredth part of the mass of wine consists of alum.

MANAGEMENT OF FOREIGN WINES.

Treatment when imported on landing.

Red Wines. The less they are exposed the better; for they are affected by the *seasons,* and more or less by the *climate.* March and April are the proper times for shipping wines from *France,* as they will be landed in the *United Kingdoms* in much the same degree of temperature. The great art in keeping wines is to prevent their *fretting,* which is done by keeping them in the same degree of heat. In *spring* and *fall* the wines in *Bourdeaux* are subject to changes that may prove dangerous, if not prevented by necessary *rackings;* these changes are solely the effect of the seasons. If wines are chilled, and of course turn *sour,* from being shipped and landed in cold weather, they will soon recover, by putting them in a warm vault, well covered with saw-dust. As soon as they are in the vault they ought to be covered up.

But if shipped or landed in summer, if the smallest degree of *fermentation* be found in them, it will be requisite to dip the bung-cloths in brandy, and to leave the bungs loose for some days, to give the wines time to cool; and if, in a fortnight or three weeks, the fermentation do not cease, and the wine become bright, it will be proper to rack it, (matching the hogshead well with brimstone) and to force it with the whites of eight eggs. If it then becomes fine, bung it tight, and let it remain so until it is bottled. If wines new landed are wanted soon for the bottle, it will be necessary to force them immediately, and let them remain bunged close for at least a month, to recover from the forcing, or if two months the better; for wines bottled in high order come much sooner into drinking than if bottled when flat, which all wines are after forcing. Wines must never be bottled

bottled the least *foul,* which produces a tendency to fret, and if bottled in this state will never come in order, but may possibly be lost; for this, it is thought there is no remedy but repeated rackings; and care must be taken (after rinsing the hogsheads well, and *drawing* them) to burn a good piece of match in them; this cools the wine, and there is no foundation for the supposition usually entertained, that it will hurt the *colour,* as it recovers it in a little time; but if it did, it is absolutely necessary; for if wine is suffered to continue on the fret, it will wear itself to nothing.

Wines bottled in good order may be fit to drink in six months; but they are not in perfection before twelve; from that to two years they may continue so; but it would be improper to keep them longer, for wines in general have not the *body* they had formerly, from the *vines,* by the present mode of *culture,* being too much forced. It sometimes happens that wines, *scuddy* and stubborn, will not *fall* with one, or even two forcings. It will then be proper to give them five or six gallons of good strong wine, and force them with the whites of a dozen eggs, with a spoonful of sand produced from the sawing of marble, or a small spoonful of table salt of the basket kind. Bottled wine should be well covered with saw-dust in *winter,* and if the vaults are cold and damp, strew it deep on the floor; if saw-dust is thrown upon the hogsheads, and their sides are bedded some inches thick, it will keep the wine from the fret.

White Wines are to be treated in the same manner, except that they require to be higher matched, particularly *Muscat Wines,* such as *Frontignac, Beziers, Malmsey, &c.* which are often partly sweetened with *honey,* and very subject to fret; these can only be kept cool by frequently racking and matching them. *Hermitage,* from not being sufficiently *dry,* and possessing more richness than *Claret,* is also very liable to come on the *fret,* and will require much the same treatment as *Muscat Wines.* Attention should be had to *bottle* in fine weather, when

when the wind is north; but to avoid cold or frosty weather. The months of April and October are favourable.

The best time to bottle port wine is four years after the *vintage*, and to keep them two years in bottle before you begin to use them. When wines are destined for warm climates, it may be proper to rinse the hogsheads with *brandy;* and in bottling to rinse the bottles and corks with it. Wines that have remained three or four months in a vault, and made less or more *lee*, ought never to be sent into the country, without first racking them, otherwise they may be liable to *fret;* and if bottled in that state may risk being lost.

Wines which may be ordered for immediate drinking, should be forced previous to their being shipped, and in a few weeks after they are landed they will be fit for bottling. The forcing proper for *red wines*, particularly Claret, are the whites of ten or a dozen sound eggs, beat up with one, two, or three tea-spoonsful of salt, and well worked into the wine with a forcing-rod; this is for one hogshead. The forcing for *white wines* is isinglass, dissolved in wine; one ounce is sufficient for a pipe; no salt is to be used in forcing white wines.

Wine may be concentrated by freezing. When wines are exposed to the action of congelation by freezing, it is the aqueous part that congeals, the spirituous part remains unfrozen. By repetition of this process, the best wines may be reduced to about one-sixth of their original volume. Wines thus concentrated, or freed from their redundant phlegm, are no longer the delicate liquors they were before; they are too unpleasant, as well as too strong to be drank by themselves; and, when mixed with other wines, communicate to them their disagreeable taint. The phlegm that is separated by freezing, retains a considerable part of their agreeable vinosity, as appears from its being convertible to *vinegar;* but this phlegm, mixed with frozen wine, does not restore its pristine qualities; both the phlegm by itself,

itself, and the mixture, soon corrupt. *Vinegar* may be more successfully concentrated by *freezing;* the aqueous parts freezing, while the acid parts remain uncongealed, with the advantage of the acid of the vinegar not being injured by this process; it still retains its specific properties, and continues as different from any of the mineral acids as before, though it can be concentrated to a degree of strength, in regard to acidity, greater than even the mineral acid of sea-salt, retaining its peculiar taste and agreeable odour in every stage of increased strength.

Wine concentrated by boiling, called Vino Cotto. This is a grand mistake. It is *Must,* not Wine, that is boiled. *Must* may be, and frequently is, evaporated, but not wine, without the loss of its vinosity and spirituosity, which would be dissipated by this process. *Must* yields nothing to evaporation or distillation but aqueous vapour; hence it may be inspissitated by boiling, and frequently is, as may be seen under *Vino Cotto. Stum* is Must unfermented. *Stum* is prevented fermenting by matching the cask with the fumes of brimstone; the fumes of brimstone are the volatile vitriolic acid in a state of vapour, and, as before observed, has the property of preventing fermentation in Must, and retards it in vinous fluids. When these fumes are condensed into the sulphuric or vitriolic acid, as in the preparation of *oil of vitriol,* it has the same effect, but in a less degree. This circumstance was well known to the Grecians, who never risked the exportation of their wines without the addition of a gill of this acid to a hogshead of the wine,—a circumstance then injudiciously reprobated by the uninformed; a class of beings, who, in every age, are ready to raise a clamour, by condemning what they do not understand. Inspissitated, or boiled Must, will not so soon fall into fermentation as the unboiled; it requires to be well *stoomed,* that is, fumigated, with brimstone, by burning several matches in the cask when empty, when quarter, half, and three quarters full, and much agitated all the time of its fumigation, and placed in a cold vault, out of the

reach

reach of the influence of the atmosphere. *See Cellarage.* Wine-merchants and their coopers know how to apply it occasionally to advantage. If it should, notwithstanding all these precautions, ferment, it becomes good wine. Nevertheless, all that has been said by ancient and modern authors, we may gather from these observations, that wine is not to be concentrated by boiling, and, that it is spoiled when concentrated by freezing; a very necessary doctrine to be promulgated in a work like this.

Forcing or fining of wines is more connected with their quality, colour, and flavour, than is generally, understood, and has a greater share in the *management* of them, after they are well *cellared* in our vaults than some may imagine. There is a *scud* or flying-lee in red wines, particularly in Claret, that will not always yield to the common forcings made use of. The same evil in red port wine is not uncommon; it frequently arises in both from incongruous mixture at the place of their growth. As these wines, as well as Burgundy, should be deep-coloured and bright before they are *bottled,* we must pursue the following means of defecation:—An obstinate *scud* may be subdued, without injury to the colour of the wine, by the addition of a small table-spoonful of glass-grinders' sand, with which they have given the rough polish to looking-glass plates, added, well beat up with the whites of the eggs intended for a hogshead of Claret. If this does not answer, the same quantity of gypsum, powdered so fine as to pass a sarcenet silk sieve, will scarcely ever fail. The eggs, and sandy or earthy addition, should be mixed up with a gallon of strong, bright, deep, Bene Carlo, Alicant, or Rousillon wine, to insure the clarification. If the wine has a tendency to acidity, the gypsum must be calcined previous to its being powdered; it may be purchased in powder very fine, under the name of plaster of Paris, from the workers in statuary or stucco. This is calcined gypsum, and must be killed in a pint of water, to prevent its *setting,* before beat up with the eggs, or mixed with the wine. This will

effectually

effectually and speedily bring down the *scud.* Port wine may be treated in a similar manner, using a heaped table-spoonful of the terrane or earthy substances, and triple the quantity of Bene Carlo wine, of Valencia, or the strong Mataro of Catalonia, partaking of the flavour of Port and Claret. Plaster of Paris, in proportion to the calcination, partakes, more or less, of the quality of lime, and will proportionably discharge the *colour.* This may be avoided, by substituting the same quantity of statuaries' sand, that has been employed for sawing marble. And, where the acid tendency is great, fragments of marble, so finely pulverized as to pass the finest silk sieve, may be employed in the same quantity, without injury to the colour. No class of people are better acquainted with *bottling* of wines than the gentlemen of the *hamper-trade,* except their coopers. See Bottling, under *Beer* and *Cider*, in Books I. and III. The *colour* of red wines, that are not sufficiently deep after being *parted* with *Rousillon* or *Bene Carlo,* may be helped with *beet-roots,* or turnsole, for Claret or Burgundy, and *logwood* for port, or other strong red wines. The beet-roots, baked with as much water as will cover them, and the colour extracted with some of the wine, when they are perfectly cold, for Claret, or the turnsole infused in the wine; and the logwood-powder steeped in the brandy used for making-up Port, or infused in chips in the wine.

White Wines. The before-mentioned terrane substances, mixed with the isinglass employed for forcing or fining, will have the same effect. Killed plaster of Paris for Madeira and Teneriffe wines that have an acid tendency; when that is not the case, glass-grinders' sand, as before, for the former, and marble-sawyers' sand, as before, for the latter, blended with the finings. For Sherry and St. Lucar wines, marble-sawyers' sand; and, when there is an acid tendency, finely pulverized marble. It being the present fashion to run upon pale white wines, particularly pale Sherry, this is at all times obtainable by adding from a pint to a quart of lamb's blood to a butt of Sherry, which

which will discharge the colour from these wines; from which it must be racked when fine. Tawney Ports and Clarets may have the colour discharged in the same manner, and restored by the colouring substances before-mentioned. Beet-root preserves the softness of Claret, and logwood helps the astringency of Port, and renders them salubrious. Gypsum,* uncalcined or calcined, improves the agreeable binding smack for which Madeira and Teneriffe wines are rendered so desirable to weak stomachs, and for which they are esteemed by delicate palates, at the same time improving their sanative qualities; nor is it less congenial to Red Port. Weak-flavoured Sherries are improved to the highest degree of flavour by bitter almonds, or the almond-cake, and a few sprigs of sweetbrier infused in the wine. *See Made Wines,* Book III. The same cake, in much less quantity, restores Madeira and Teneriffe wines to their pristine flavour. Ropy wines are cured by alum, tartar, or nitre; two ounces of alum, to one of tartar, to a pipe of Port wine; alum, nitre, and tartar, of each half an ounce, for a hogshead of Claret or white wine; if on the decline, double these quantities. Ropy wines in bottle should be shook, and left in an attic story till they recover, which will be soon in summer. When Burgundy, Champaign, or Claret, in the wood, or Sherry or other wine, not arrived at maturity, that require to stand any time on the forcing, are discoloured, jelly of starch must be used instead of blood to discharge the colour, it being of an incorruptible nature; a pound, made into jelly, for a hogshead.

Cellarage. Deep and dry cellars, from which the *air* and *light* are shut out by double doors and double window-shutters, are the best repositories for fermented fluids. If in situations that are still and quiet so much the better, but this is not easily procurable in great cities, the buildings in which are shook to their foundations by heavy carriages passing through the streets. Agitation promotes fermenta-

 tion;

* Sulphat of lime.

tion; consequently it disturbs the *lees* of fermented fluids, the rising of which, from whatever cause, *heat* or *motion*, induces those liquors to *fret*. Any thing that disturbs the progress of insensible fermentation, a process always going on in the fermented fluids in their advance towards maturity, accelerates it; and, when arrived at maturity, promotes their decline. No authentic observations inform us, that *heat* increases in proportion as we penetrate below the surface of the earth; on the contrary, many shew it to decrease, though never to less than thirty-six degrees; and that its variation at the same depth below the surface, constantly keeps pace with the variation of the *solar heat* on the surface. It therefore appears evident, that it is to this planet alone the earth owes its heat. That water at one certain depth below the surface of the earth is, in all latitudes, at the same temperature, is a well-known fact. This warrants the equality of temperature at a certain depth below the surface; which may be derived from its being nearly below the reach of the influence of the changes impressed on the atmosphere. Thirty-six degrees is about this temperature, below which vegetation rarely sinks, and at which evergreens can flourish, and insensible fermentation with safety proceed in wines approaching to maturity.

Wines on the *fret* should be racked; and, if their own *lee* indicates decay, they should be racked on the sound *lee* of another wine of a similar, but stronger, quality, to protract their decline. If this is done at an early period, it may renovate the sick wine. On these occasions, give the sick wine a cooler place; it will retard its progress to acidity. If convenient such wine should be *forced* and *bottled*. Previous to bottling, or rather at the forcing, give it two or three table-spoonsful per pipe of uncalcined gypsum, exceedingly well pulverized; this will check its tendency to acidity, without exciting much intumescence, without injuring the colour of red wine, *and without retarding its coating on the bottle, which it rather promotes*. *Large cellars* should be divided, and subdivided by double doors, to prevent the admission of the

the air unavoidably introduced on opening the door of the anti-cellar; opposite to which one vault should go to the whole extent of the *cellars,* and the separate cellars, right and left, parted off by double doors on each hand. Vaulted roofs are indispensable to almost all wines that are not of the Madeira or Teneriffe quality, which are the better for exposure to the vicissitudes of the atmosphere. *Frederic Hoffman,* and after him *Caspar Neumann,* both eminent physicians and great chemists of Germany, in their description of the wines of that country, seem to attribute, in a considerable degree, the excellence of the wines of the *Jesuits' College* at Vienna, to the great depth of their cellars, which they observed was as much below the surface of the earth as the church steeple of the college was above it. Port wine, and other wines of that class, may be kept sufficiently warm in cold cellars, packed in saw-dust, dry sand, or bone-ashes. The packing, or stowing away, wines or other fermented liquors in *bulk,* is a bad practice, particularly in the manner it is done in the open cellars of these kingdoms, which are exposed to the fluctuating changes of our unsteady atmosphere, the sudden and frequent alterations of which are more or less injurious to them, impairing their quality, and reducing their value. This might be remedied, by having grooved upright posts, and sliding boards to slip in and out, as the bottles are piled up, or taken down; into which the sawdust, &c. might be put, so as to cover or defend the extremities of the bottles in each stratum or layer, by converting the piles of bottles in *bulk* to occasional *bins.* This would not only prevent a *fret,* but a hasty maturity, and rapid decline of the vinous liquors, at present so negligently disposed of by those unapprized of the danger.

By this time I hope the reader knows how to make thin wines full, weak wine strong; and over-full wine thin, and over-strong weak, without injury to their vinosity, flavour or quality. To assist the colour, flavour, scent, and brightness in wines; to recover from a *fret*; to restore when *flat*; to renew *briskness;* to mend when *tawney;* to

cure

cure when *prickt;* to restore when *faint;* to clarify when *foul;* to cure when *ropy,* &c. And also to resolve these *problems;* the cause of acerbity, of acidity, of sharpness, of roughness, of thinness, of fulness, of briskness, of mantling, of sweetness, of dryness, of astringency, &c. in wines; and, by the confidence acquired, to become perfect master of the best way of managing Foreign Wines in these kingdoms.

CONSTANTIA WINE.

Many years having elapsed since I was at the Cape of Good Hope, I entertained a wish to see what had been said by Captain Robert Percival on the wines of the village of Constantia, and in order to enrich this work with all the information procurable, as what I had learned during the short stay I made at the Cape, amounted to nothing more than a visit to the village, without seeing the vineyard, or its proprietor, and, going to sea immediately after, was unable to obtain any other information, than, that the produce was small and very dear. The red and white Constantia, procured for me as samples, I had reason to believe were genuine; they proved exceedingly luscious, rich, mellow wines, bordering upon the Tokay flavour. The other wines commonly drank were cheap, but not very good. The following sketch I have extracted from his Description of the Cape, published in 1804.

"The sweet, luscious, and excellent wine, called Constantia, so highly esteemed in Europe, is made at the village of Constantia, the produce of two distinct plantations, the one producing red, the other white wine; the grapes are a species of the Muscadel, from which they are extracted, large, fleshy, and extremely sweet and luscious. The exquisite flavour of the wine is attributed to the attention paid in its

its culture and preparation." *The history of which he has not favoured us with.* " The quantity made is about seventy-five legars a year, of one hundred and fifty gallons each. The produce is divided into three parts, one third of which is furnished at a certain price to the Dutch East India Company, who send it to the Government of Holland; another third to the Rulers at the Cape, at the same rate; and the wine planter is at liberty to dispose of the remainder to strangers and others; the price of which fluctuates according to the demand, or the increase or decrease of the produce, and not always procurable at any price. *Mynheer Pluter,* the proprietor, usually retails it at the vineyard at two dollars a bottle. The other wines of the Cape are cheap, and not only inferior to Constantia, but to the wines whose names they assume, as Muscadel, Moselle, Cape-Madeira, Vin de Grave, Rhenish, &c. They have no production so abundant or profitable as a wine farm; it is computed, that an acre of vines may contain about five thousand stocks, (vines) which may produce, on moderate calculation, seven hundred gallons of wine; their inferiority he attributes to the slovenly manner they are cultivated, pressed, and prepared in. The retail price of these wines is from four to six pence a bottle, which is, from ten to fifteen pounds a legar; the wholesale price from eight to ten pounds a legar, British currency, as he calls it. Pursuing Captain Percival's observations, I beg leave to observe, that an acre, presumed to produce seven hundred and fifty gallons of wine, that is, five legars, at eight or ten pounds a legar, is from forty to fifty pounds an acre. This wine, carefully made and well managed in its progress to maturity, might be sold to much better advantage; how far it may excel all other productions in its annual returns, I leave to the decision of such readers as are better skilled in agricultural and commercial estimates. I think it within the range of probability to find as productive a vintage in some of our cider counties.

FINIS.

G. SIDNEY, Printer Northumberland Street, Strand.

Directions to the Binder for placing the Printed Tables.

Tables, No. III. and IV. (Brewing for Porter and Ale)—to follow page 307—Book I.

Distillers' Spirit Table—to face page 203—Book II.

Malt Distiller's Tables, No. I. and II.—to face page 248—Book II.

Estimates made in 1786—to follow page 135—Book III.

Directions for placing the Plates.

Plates, No. I. II. III. and IV.—to face page 116—Book I.

Plates, No. V. VI. and VII.—to follow page 248—Book II.

Plate, No. VIII.—to follow page 183—*Appendix.*